BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS FOR CHEMICAL AND PETROLEUM PLANTS, JULY 1954 -- DECEMBER 1956

By Sidney Katell

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BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS FOR CHEMICAL AND PETROLEUM PLANTS, JULY 1954-DECEMBER 1956[1]

by

Sidney Katell[2]

INTRODUCTION

This report is the fourth in the series, Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants. The initial work, Bureau of Mines Information Circular 7516, was published in October 1949 in conjunction with the synthetic liquid fuels program authorized by Public Law 290, 78th Congress. It included references to and abstracts of publications appearing from 1930 to September 1948 on all processes in general use in the petroleum refining and chemical industries. A supplemental bibliography, Bureau of Mines Information Circular 7705, was published in January 1955 to cover the period September 1948 through June 1952; and Supplement 2, Information Circular 7751, published in September 1956, covered the period June 1952 through June 1954. The present supplement covers the period July 1954 through December 1956.[3]

The information in this paper was obtained from the following sources:

1. Bureau of Mines Information Circulars.
2. Bureau of Mines Reports of Investigations.
3. Chemical Engineering.
4. Chemical Engineering Progress.
5. Chemical Engineering Costs Quarterly (Cost Engineering).
6. Industrial and Engineering Chemistry.
7. Mines Magazine, the Colorado School of Mines.[4]
8. Nucleonics.
9. Oil and Gas Journal.
10. Petroleum Engineer.
11. Petroleum Processing.[5]
12. Petroleum Refiner.
13. World Oil.

No attempt was made to include every news item. This type of information appeared in several of the publications under such headings as Business and Industry, Companies in the News, Headlines of the Month, Industrial News, Industry, Refining and Gas Processing News, Refining News, What's Happening, Who's Building, and others.

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[1] Work on manuscript completed January 1958.

[2] Supervisory chemical engineer, Process Economics Evaluation Staff, Bureau of Mines, U. S. Department of the Interior, Morgantown, W. Va.

[3] Only articles containing domestic cost information have been included in this bibliography.

[4] Abstracted to December 1955 only.

[5] Abstracted to June 1956 only.

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ACKNOWLEDGMENTS

This report was prepared by the Process Economics Evaluation Staff of the Branch of Coal Gasification, Bureau of Mines, Morgantown, W. Va., under the general direction of L. L. Hirst, chief of the branch. Acknowledgment is made of the valuable assistance in compiling the report given by Gloria Cunningham and Lyhle Gillenwater, former members of the staff.

ABSTRACTS

A

1. ABBOTT, M. D., LIEDHOLM, G. E., AND SARNO, D. H. Shell Upgrades Stock by Hydrodesulfurization. Oil Gas Jour., vol. 54, No. 11, July 18, 1955, pp. 92-94.

    Describes selective hydrodesulfurization process used by Shell Oil Co., including process flow operation, catalyst selectivity, product properties, costs, and yields. A table giving capital and operating costs shows that a plant having a capacity of 10,000 barrels per stream-day will cost $2,000,000, excluding offsite facilities. Operating costs are estimated at 13.1 cents per barrel for catalytically cracked naphtha.

2. ADAMS, ERNESTINE. Trucks: Magic Carpet and Muscles of the Petroleum Industry. Petrol. Eng., vol. 27, No. 10, September 1955, pp. A-43 - A-54.

    Discusses trucks in petroleum industry, including types of trucks, utilization of trucks in various phases of the petroleum industry, and cost of trucks. Latter information is tabulated, giving highest and lowest cost paid by oil companies for 15 types of trucks and auxiliary equipment.

3. ADAMS, HOWARD, AND McCARTHY, R. A. Engineering Aspects and Evaluation. Evaluating Plastics for the Chemical Industry. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1294-1299.

    Compares general properties of plastics with more conventional materials of construction and includes a table of such properties for overall plastics and for 10 generic groups, as well as glass, rubber, steel, aluminum, copper and wood. Cost of raw materials per pound is included for the 10 generic groups, which include phenolic, amino, reinforced plastic, vinyl, cellulose, styrene, arcylic, ethylene, nylon and halocarbon. Gives two examples of how plastics can be used in chemical industry to control choice of material for a particular job.

4. ALDERSON, WILLIAM T. Factors That Influence Selection of a Compressor. Chem. Eng., vol. 63, No. 6, June 1956, pp. 188-195.

    In spite of many arguments favoring various compressors, economic factors will govern selection. Discusses factors to consider before positive displacement and dynamic machines are selected. Presents table giving operating expense of transmission-station compression equipment for 16 companies.

5. ALLEN, ARNOLD, AND OTHERS. Symposium on Capital Cost Estimation. Chem. Eng. Prog., vol. 52, No. 5, May 1956, pp. 171-178.

    Discusses techniques for cost estimation based on experience of the seven companies represented on panel. A comparison of methods was revealed through the discussion, as well as standard practices used. Correction factors employed, degrees of accuracy achieved, cost indexes preferred, etc., were also covered throughout discussion.

6. AMBLER, C. W., JR. Zinc Anodes Provide Long-Life Design. Oil Gas Jour., vol. 54, No. 85, Dec. 17, 1956, pp. 155-156.

Discusses use of zinc anodes for cathodic protection and compares use of zinc vs. magnesium from the standpoints of installation labor cost and total installation cost. One curve gives a picture of the cost of installing an underground protection system.

7. ANDERSON, E. D., AND FLAXHARD, E. W. Economics of Heat-Exchanger Design. Petrol. Refiner, vol. 34, No. 1, January 1955, pp. 159-163.

Presents series of curves designed to aid in rapid selection of most economical exchanger for a specific purpose.

8. _____. What Determines Which Heat Exchanger Is Your Best Buy? Oil Gas Jour., vol. 53, No. 25, Oct. 25, 1954, pp. 100-103.

An analysis of comparative construction and capabilities of basic heat-exchanger types and cost graphs for various types and sizes of exchangers.

9. APT, JEROME, JR. The Dorfan Impingo Filter. Chem. Eng. Costs Quart., vol. 5, No. 3, July 1955, pp. 75-77.

Describes operation, design, and efficiency of this filter and very briefly summarizes investment and maintenance costs.

10. ARCAND, H. J. Chemical Feeders. Chem. Eng. Costs Quart., vol. 6, No. 4, October 1956, pp. 97-101.

Discusses importance of feeding in chemical-manufacturing operations and describes typical feeders and costs. Costs for six different types of feeders are given, including Omega Universal, Omega Loss-in-Weight, Omega Belt-Type Gravimetric, Omega Rotolock, Omega Disc, and Omega Rotodip.

11. _____. Lime Slakers and Silica Activators. Chem. Eng. Costs Quart., vol. 6, No. 4, October 1956, pp. 102-103.

Briefly describes uses for lime slakers and activators and gives costs for three different sizes of each.

12. ARDERN, D. B., AND LASSIAT, R. C. Disposal of Refinery Waste Gases. Petrol. Eng., vol. 26, No. 8, August 1954, pp. C-7 - C-10.

One company saves $100,000 a year by burning CO catalytically in cat cracker waste gases.

13. ARENS, JOHN E. Depreciation. Petrol. Eng., Ref. Equip. Issue, vol. 28, No. 8, July 15, 1956, pp. E-12 - E-13.

Discusses some economic and financial implications of depreciation.

14. AUCOIN, P. J. Tax Law Changes. World Oil, vol. 140, No. 3, February 1955, p. 124.

Briefly discusses depreciation features of new Federal tax law.

B

15. BADGER, W. L., AND STANDIFORD, F. C. Engineering in Salt Manufacture. Chem. Eng., vol. 62, No. 3, March 1955, pp. 173-177.

Authors describe improvements in equipment, operating methods, and processes that have contributed to modernization of saltmaking plants and reduced costs.

16. BAEDER, DONALD, L., AND SIEGMUND, C. W. Hydrofining Is a Natural for Naphthas. Oil Gas Jour., vol. 53, No. 42, Feb. 21, 1955, pp. 122-124, 126.

Discusses Standard Oil Development's Hydrofining process; gives advantages, process description, charge and product data for virgin and cracked naphthas and for tractor fuel, coker naphthas, and solvent naphthas. Investment cost for a 10,000-barrel-per-day plant is about $90 to $100 per barrel; operating costs run 10 to 15 cents per barrel. If hydrogen must be manufactured specifically by Hydrofining, aforementioned investment costs are about 45 percent higher. In certain specific instances, where operation is extremely mild, investment costs are as low as $70 to $90 per barrel.

17. BAKER, DEXTER F. Low-Temperature Processes. Chem. Eng. Prog., vol. 51, No. 9, September 1955, pp. 399-402.

Discusses four of the less widely publicized applications of industrial gas purification by low-temperature processing and the economics of each. The four applications include (1) hydrogen purification, (2) purification of methane, (3) purification of ethylene, and (4) purification of CO.

18. BALE, E. S., MAST, E. L., AND WEBSTER, R. E. Keep Those Maintenance Costs in Line. Oil Gas Jour., vol. 54, No. 56, May 28, 1956, pp. 112-116.

Describes a method developed by Sohio for determining total direct maintenance cost and arriving at a maintenance ratio and index. Included are graphs showing (1) total direct maintenance cost for a number of refineries in cents per barrel of crude throughput, (2) maintenance costs for major units in Sohio refinery, (3) maintenance cost on individual units at various refineries, and (4) cost of maintenance on various types of cracking units and crude processing units.

19. BALL, DOUGLAS. Types of Underground Liquid Storage. Petrol. Eng., Ref. Ann., vol. 26, No. 8, July 15, 1954, pp. E-21 - E-24.

Discusses the three types of suitable structures. Brief storage cost figures are included.

20. BARNES, KENNETH B. 1956 Budgets Increased 22 Percent. Oil Gas Jour., vol. 54, No. 39, Jan. 30, 1956, pp. 168-169.

Presents the Journal's study of oil and gas capital expenditures (budgeted) for 1956 and the percent increase over 1955. Expenditures for capital items by the oil industry are estimated at $4,471,000,000 and $1,205,000,000 for the gas industry.

21. BARR, FRANK T., AND JAHNIG, C. E. Fluid Coking and Fluid Coke. Chem. Eng. Prog., vol. 51, No. 4, April 1955, pp. 167-173.

Describes fluid coking process and economics of fluid coking on the Gulf coast. Latter is based on 10,000 barrels per stream-day of vacuum-pitch feed from South Louisiana and Hawkins crudes.

22. BARTZ, M. H., AND BURNHAM, J. B., JR. Hot Cell for Testing MTR-Irradiated Specimens. Nucleonics, vol. 12, No. 11, November 1954, pp. 42-43.

Hot cell described and cost figures given.

23. BATES, G. R., ENGLISH, J. E., AND FRANKLIN, G. M. Stanolind's Experiences Show VPC to be Economical, Efficient, Simple. Petrol. Eng., vol. 28, No. 10, September 1956, pp. D-25 - D-29.

Method of vapor-phase cooling is described, showing that substantial savings in fuel, water and equipment can result if steam can be utilized.

24. BAUMAN, H. CARL. Estimating Costs of Process-Plant Auxiliaries. Chem. Eng. Prog., vol. 51, No. 1, January 1955, pp. 45-J - 50-J.

Presents cost data for chemical-plant auxiliaries, including structures, equipment, and services that do not enter directly into chemical process. Cost ranges for chemical-plant auxiliaries and for chemical-plant auxiliary buildings are tabulated and also shown graphically.

25. BAUMANN, G. P., AND SMITH, M. R. Isobutylene Separation With Sulfuric Acid. Petrol. Eng., vol. 26, No. 12, November 1954, pp. C-22 - C-25.

Discusses Standard Oil Development Company's combined extraction-regeneration recovery process for isobutylene recovery. Includes economic data on isobutylene manufacture.

26. _____. Separation of Isobutylene. Oil Gas Jour., vol. 53, No. 21, Sept. 27, 1954, pp. 71-73.

Discusses extraction-regeneration process for manufacturing isobutylene. Describes process, chemistry, products, and economics. Based on 80 tons of isobutylene product for 6,300 barrels of feed per day, an onsite plant investment of $2,000,000 is required.

27. BEDFORD, G. T., WEEKS, W. J., AND CATERSON, A. G. Titanium Moves Into Process Equipment. Chem. Eng., vol. 63, No. 12, December 1956, pp. 238-248.

It is predicted that in next 5 to 10 years, as the downward price trend of titanium continues, demand from chemical process field and allied industries will equal if not surpass that of aircraft industry. At today's price of $8 - $15 per pound, titanium is most economical material of construction in many applications. A table compares cost of stainless steel and titanium.

28. BEECHERL, L. A., JR. Condensate Extraction From Lean Gas. Oil Gas Jour., vol. 53, No. 33, Dec. 20, 1954, pp. 91-92.

Presents results of survey made to determine best procedure for economically extracting liquids from 2,700 M c.f.d. of lean South Texas casinghead gas. Includes a brief cost summary (investment and operating costs, revenue, and payout) of an absorption-type unit,

29. BEESON, H. H. Economics of Ethane Recovery. Oil Gas Jour., vol. 54, No. 50, Apr. 16, 1956, pp. 195-196.

Describes properties of ethane and principal uses to which it has been put. Recent prices paid for ethane have been 50 cents per M cu. ft. for a 90-percent-pure product (approx. 2 cents per gallon) and residue-gas value for a methane-ethane mixture. Recovery of ethane can be accomplished with a minimum investment for additional equipment. This equipment may cost about $50,000 per MM cu. ft. of ethane per day, which would pay out in less than 6 months. Effect on economics of ethane recovery when a residue-gas sales contract provides for a price increase for B.t.u. over 1,000 is illustrated by an assumed case.

30. BELDEN, D. H. Penex and Platforming Team Up. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 149-152.

By using the Penex process in conjunction with Platforming, a more economical refining technique results than by using catalytic reforming alone or other refining processes. Comparisons using Arabian and Wyoming stocks, reflect the following advantages to the combined process:

	Operating costs and profitability			
	Increase in gasoline production	Net value of increased gasoline after deducting expense	Additionsl capital investment	Payout on investment years
Arabian	13.3	$2,520	$1,700,000	1.9
Wyoming	12.8	2,470	1,850,000	2.1

31. BELL, J. S., AND DEVEAUX, D. R. Why Prestressed Concrete in the Refinery? Petrol. Refiner, vol. 33, No. 7, July 1954, pp. 123-126.

Discusses principles and advantages of prestressed concrete for refinery storage tanks and compares type with normal reinforced concrete. Cost figures for prestressed concrete are compared with steel tanks for several situations.

32. BENEDICT, MASON. Nuclear Reactors for Research. Chem. Eng. Prog., vol. 51, No. 2, February 1955, pp. 53-F - 66-F.

Discusses briefly how research reactors work, uses to which they may be put, types of reactors available, their cost, and their safety problems. In discussing types of reactors, costs are given for 6 natural-uranium-graphite reactors, for 7 natural-uranium-heavy water reactors, for 5 water-boiler reactors, and for 9 solid-fuel-enriched reactors.

33. BERG, CLYDE. Signal Hill, Calif., Plant gets First Commercial Hyperformer. Oil Gas Jour., vol. 53, No. 13, Aug. 2, 1954, pp. 91-92.

Discusses principles involved in this particular hyperformer and includes tabulated utility, operating, and investment costs of the Signal Hill unit, as well as anticipated product yield and processing conditions. Also included are properties of typical feed and hyperformate products.

34. **BERG, CLYDE.** The Design of Hyperforming Units. Petrol. Refiner, vol. 33, No. 10, October 1954, pp. 153-157.

Discusses first commercial application of this new process. Included are investment and operating costs.

35. **BERKELEY, F. DUNCAN.** Air Ejectors Cheaper than Steam. Chem. Eng., vol. 61, No. 11, November 1954, pp. 164-168.

Explains neglect of air-operated ejectors in field of vacuum-producing apparatus in favor of highly successful steam ejector. Improvements in air ejectors over the years have greatly reduced cost of compressed air, and greater availability of such air now makes air ejector a reasonable - and in some instances a preferred - means of producing a vacuum. Three graphs are presented showing operating costs of 1- and 2-stage air ejectors when cost of compressed air is known. Instances are also cited when air ejectors would be preferable to steam type.

36. **BERTELLI, J. W.** Economics of Run Length Determination. Petrol. Refiner, vol. 34, No. 3, March 1955, pp. 134-137.

Presents mathematical method for determining optimum length of a run. Discussion is confined to runs in which economics is sole factor in shutdown.

37. **BEZENAK, W. HOWARD.** Report to Management. From Vision to Supervision: Selecting the Contract and the Contractor. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 19A-22A.

No actual costs are given, but a detailed account discusses three types of contracts and compares them in tabular form from their nine principal component parts.

38. **BIERWERT, D. V., AND KRONE, F. A.** Engineering Your Cost Reduction. Chem. Eng., vol. 62, No. 7, July 1955, pp. 207-210.

Discusses three major types of standard cost systems and contribution that engineers can make toward improving these systems. Value of engineering approach is illustrated by a hypothetical case.

39. **BLACK, J. M.** Engineering in Plant Revamp Work. Ind. Eng. Chem., vol. 46, No. 12, December 1954, pp. 2471-2474.

Comparatively young and rapidly advancing fields of petroleum and petrochemical industries are a fertile area for plant adaptation or revamping. Because fixed-price bids are less practical and there is a tendency to underestimate in the case of a so-called revamping project, those items that most greatly influence final dollar figure are highlighted and discussed.

40. **BOGART, MARCEL J. P., AND DODD, ROBERT H.** Recent Developments in Wulff Acetylene. Chem. Eng. Prog., vol. 50, No. 7, July 1954, pp. 372-375.

A description with accompanying flowsheet, of Wulff process for converting hydrocarbons to acetylenes. Assuming a 50,000,000-pound-per-year acetylene-from-natural-gas plant as a basis, the following information is given: Material balance, detailed process calculations for both single-pass and recycle cracking operations, and comparative cost data for both these operations.

41. BOLLES, WILLIAM L. New Process Design Methods for Optimum Bubble-Cap Tray Design. Part IV - Design Example. Petrol. Proc., vol. 11, No. 5, May 1956, pp. 109-120.

Tower costs, cost of trays, cost of column, and other items are presented in tabular form for various designs.

42. BONER, C. J. Addition Agents for Lubricants, Part I. Petrol. Eng., vol. 28, No. 3, March 1956, pp. C-53 - C-65.

Discusses dosages and cost of various additives to achieve desired characteristics.

43. BONNER, M. K. Heat-Loss Graph Aids Engineers. Petrol. Eng., vol. 26, No. 7, July 1954, pp. C-49 - C-50.

A heat-loss graph is presented and an example given to aid in determining most economical thickness of mineral-wool block or board insulation in specific cases.

44. BORST, L. B. Subcritical Reactor in a Pickle Barrel-NYU's Training Tool. Nucleonics, vol. 14, No. 8, August 1956, pp. 66-69.

Describes New York University's subcritical system and gives budget for a similar system.

45. BOWEN, H. J. Scale Models. Chem. Eng., vol. 61, No. 8, August 1954, pp. 175-189.

Stresses importance of adapting use of scale models of chemical plants to design and construction work. Because of increased investment cost today's designer needs an engineering tool that will reduce design, capital, and maintenance costs, that will speed up construction and operator training for faster start-up, and still result in a well-designed plant. Engineering-scale models are helping him achieve this goal. A tabulation is given showing process-plant cost elements and estimated savings possible through use of a model.

46. BOWLES, OLIVER. The Asbestos Industry. Bureau of Mines Bull. 552, 1955, 122 pp.

Discusses asbestos industry in general, including distribution, world reserves, marketing, and prices.

47. BRACKETT, WILLIAM S. Who Does the Designing? Ind. Eng. Chem., vol. 47, No. 5, May 1955, pp. 27A-30A.

In discussing two principal functions of a design group, importance of cost information is stressed. The division of investment in a large chemical plant is tabulated and also shown graphically, categorized into "labor" and "all other."

48. **BRADLEY, BRYANT W.** Petroleum Production. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1353-1358.

Summarizes a few experiences with plastic pipe and tankage in oil-producing operations. Present cost of these materials is compared with cost of materials that they must successfully and economically replace. Also concludes that reported plastic strengths do not always show true strength in water and that truer strength values must be made available.

49. **BRANDON, A., AND ZAHNSTECHER, L. W.** Refinery Integrates Three Hydrofiners. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 166-168.

Esso Standard Oil estimates that cost of its Baltimore plant for catalytic reforming was reduced 15-20 percent by building an integrated unit combining a Power former operating in conjunction with three Hydrofiners instead of two individual Hydrofiners and a separate Power former with its Hydrofiner pretreat. Flowsheets of the integrated design and tables reflecting increased yields are included.

50. **BREAZEALE, WILLIAM M.** Research Reactors - Selection and Operation. Nucleonics. vol. 14, No. 11, November 1956, pp. 77-80.

Types of research reactors are discussed, along with operating costs.

51. **BRIDGEWATER, ERNEST R.** The Professional Man - Profits. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 29A-30A.

Briefly summarizes comments made by Bridgewater in his talk "Profits" at the ACS Division of Rubber Chemistry meeting in Detroit. It is pointed out that number of dollars earned by a company or relationship of profit to sales may sometimes be misleading in deciding whether or not a company has done well. One other factor that must be considered is turnover. The following mathematical relationship is suggested:

$$\frac{\text{Profit}}{\text{Sales}} \times 100 = \%\ \text{profit on sales},$$

$$\frac{\text{Sales}}{\text{Investment}} = \text{turnover},$$

$$\text{Turnover} \times \%\ \text{profit on sales} = \%\ \text{return on investment}.$$

52. **BROOKE, MAXEY.** Economics of Softening Cooling Water. Petrol. Refiner, vol. 33, No. 10, October 1954, pp. 145-146.

Discusses economics of water-softening system for a hypothetical refinery of 75,000-barrel-per-day capacity.

53. **BROOKS, B. T., AND BRIEN, E. B.** New Phase Develops in Petrochemicals. Petrol. Eng., vol. 26, No. 8, September 1954, pp. C-7 - C-10.

Discusses price declines in the petrochemicals market. Theory is advanced that new normal levels may have developed.

54. **BROWN, JUDSON G.** Reversible Filtration. Chem. Eng. Prog., vol. 52, No. 6, June 1956, pp. 238-240.

A process aimed at decreasing average cake thickness and improving cake discharging as a means to reducing cost of filtration. A comparison of cost between standard rapid sand filter and reversible filter indicates such a reduction by use of latter method.

55. BROWN, REX N. Graphic Wattmeters Used to Balance Pumping Cycle. World Oil, vol. 139, No. 7, December 1954, pp. 177-180, 182, 184.

Application of graphic wattmeter to balance operation cycle of an electrically powered pumping unit has resulted in a considerable decrease in electric power consumption and, therefore, a decrease in electrical cost per barrel of fluid in case of marginal wells with low gas-oil ratios. Several other advantages are also evident in a planned time schedule, including lower maintenance and operating costs.

56. BUREAU OF MINES. Technology of Lignitic Coals. Part 2: Combustion; Gasification; Hydrogenation; Other Chemical Processing. Inf. Circ. 7692, 1954, 120 pp.

Summary report of studies on utilization of lignite. Some investment and operating costs are included. These are concerned with electric-power production for plants using lignite as a fuel.

57. BUSEY, HAROLD M., AND HAMMOND, R. PHILIP. Test-Tube Reactor. Nucleonics. vol. 13, No. 11, November 1955, pp. 72-75.

Highest usable neutron flux at minimum cost is achieved in modified water-boiler-type reactor.

58. BUTLER, C. A., JR. Keep Cost Estimates Realistic. Chem. Eng., vol. 62, No. 1, January 1955, pp. 171-175.

Discusses hazards of underestimating and overestimating costs and the engineer's responsibility in cost estimating.

C

59. CABLE, JACK A. How to Select Centrifugal Pumps. Petrol. Refiner, vol. 35, No. 9, September 1956, pp. 341-344.

A discussion of three different types of pumps used in various applications of refinery pumping, that is, single suction type of pump, double suction pumps, refinery-process-type pumps, their selection and cost.

60. CALISLE, V. J. Continuous Blowoff Will Save B.t.u.'s. Petrol. Proc., vol. 9, No. 8, August 1954, pp. 1230-1233.

Presents data for calculating quickly savings in B.t.u. resulting from boiler-plant waste-heat recovery through continuous blowoff. Included in data are annual savings for varying rates of blowoff at various pressures.

61. CAMERON, D. F., AND WEAVER, R. T. Still Polyforming in Your Plant? Petrol. Refiner, vol. 34, No. 7, July 1955, pp. 161-164.

Presents economic study of effect of butane price and butane/naphtha ratio in feedstock on profits.

62. CAMPBELL, JOHN M. Knitted-Wire Mist Extractors - and How They Work. Oil Gas Jour., vol. 54, No. 44, Mar. 5, 1956, pp. 115-116.

In a discussion of use of knitted-wire-mesh screen for mist extraction following installation costs are cited: Using 18-8 stainless, cost for 75 percent of installation will be about $9-10 per square foot. Carbon-steel units cost about 25 percent as much.

63. _____. Know Your Separators....They Are the Key to Field Processing. Oil Gas Jour., vol. 53, No. 45, Mar. 14, 1955, pp. 107-111.

Discusses types of separators, operating characteristics, costs, and how to determine size to use.

64. _____. Methods for Gas Dehydration for 1954. Petrol. Eng., vol. 26, No. 10, September 1954, pp. C-11 - C-17.

Discusses new applications and techniques for gas dehydration. Investment and operating costs included.

65. _____. Separation of Natural-Gas Liquids - 6. Oil Gas Jour., vol. 53, No. 18, Sept. 6, 1954, pp. 123-124.

This is final installment of the series on Separation of Natural-Gas Liquids. A sample calculation is presented, as well as a comparative economic summary of various systems for separating natural-gas liquids.

66. _____. Stabilization of Separator Liquid. Oil Gas Jour., vol. 54, No. 19, Sept. 12, 1955, pp. 120, 122, 123, 126, 128.

Discusses stabilization of separator liquid units, including equipment design and operation, gradient recovery, feed temperatures and pressures, and material balances. One graph is presented that is convenient for estimating cost of stabilization equipment, including all necessary accessories.

67. CAPLAN, B. V., AND DAVIDSON, J. K. Reactor-Fuel Processing - a New Chemical Business? Chem. Eng. Prog., vol. 51, No. 11, November 1955, pp. 493-496.

Discusses fuel-cycle cost in atomic power and necessity for achieving a lower fuel-cycle to have atomic power that will be competitive in near future. Two solutions to reducing this fuel cost are known: (1) Develop a fuel element that can endure a long irradiation and then be stored indefinitely, and (2) process spent fuel at a cost low enough to allow a credit to be taken for unburned and newly formed fissionable material recovered. Economics of both these alternatives is compared.

68. CARMINE, CREIGHTON C. Where Your Maintenance $ Go. Petrol. Proc., vol. 11, No. 6, June 1956, pp. 48-53.

Presents ways that permit closer cost accounting of maintenance jobs.

69. CARPENTER, M. T. Control of Research Costs. Chem. Eng. Prog., vol. 52, No. 6, June 1956, pp. 64, 82-84, 88.

Discusses factors that contribute toward formulating answers to questions of how much to spend on research, how to judge whether research money is being spent wisely, and how to discover if, and at what rate, research has earned money for a company.

70. CASPER, JOHN C. Realization Now at a 2-Year High. Oil Gas Jour., vol. 54, No. 51, Apr. 23, 1956, pp. 76-77.

Discusses trend in refinery realization and presents tables reflecting these trends for Gulf coast refineries and for Mid-Continent refineries as of March 1955 and March 1956. The percentage yield, gallons per barrel, price, and value are given for (1) gasoline, (2) kerosine, (3) distillate and residual, and others. Another column gives change in value from 1955 to 1956.

71. CAUTHEN, WILLIAM C. New Refinery Trades Coke for Power. Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 141-145.

Tidewater Oil Co. constructs new powerplant to supply electric power for its new refinery, using first boilers designed specifically for firing with fluid coke. Despite fact that capital cost of power station was increased somewhat above minimum required investment, pro rata share of initial capital investment chargeable to production of power is estimated at about $160 per kilowatt of nameplate capacity. This compares favorably with average cost of modern fuel-burning plants in same area.

72. CHARTENER, WILLIAM H. Chemicals Lead in Private Research. Chem. Eng., vol. 61, No. 7, July 1954, pp. 331-334.

Tabulation prepared by Harvard Business School and McGraw-Hill Dept. of Economics showing how private industry spends its research money in three categories: New products, basic research, old products. Statistics show that chemicals and allied products have highest privately financed research (exclusive of Government contributions) budgets.

73. CHARTENER, WILLIAM H., AND THOMPSON, EDWARD T. Depreciation Dons a New Look. Chem. Eng., vol. 61, No. 12, December 1954, pp. 171-174.

Effect of a new law passed by the Congress liberalizing methods for figuring plant depreciation is shown by comparing methods under old and new laws, using a theoretical $15,000,000 ammonia-urea plant as a basis for example.

74. CHEMICAL ENGINEERING. Capitalized Cost vs. Annual Cost. Vol. 62, No. 12, December 1955, pp. 183-184.

A reader writes to the editor regarding Dr. F. C. Jelen's article on use of capitalized cost as a basis for calculating the economics of replacements. G. C. Lammers prefers the "annual cost" method for this purpose and states that this latter method is "more straightforward and less cumbersone." Dr. Jelen replies that "capitalized cost" method "avoids confusion and errors often found in annual cost analysis."

75. _____. Cuts Extreme Pressure Cost. Vol. 61, No. 10, October 1954, p. 268.

European engineers are using vertical compressor as a cost-saving, smooth performer in chemical synthesis where higher pressures are involved. Aside from mechanical advantages over more conventional horizontal-type compressor, it has been found that vertical units offer noteworthy savings on initial expenditure, operating and maintenance expenses. On building and foundation costs a 75-percent saving has been noted and floor space is only 30 percent of that needed for horizontal compressors.

A comparison between 7-stage horizontal and vertical compressors is given, including performance of each, space required for each, and installation cost of each. This comparison is favorable in all respects to vertical compressor.

76. CHEMICAL ENGINEERING. How Equipment Costs Are Moving. Vol. 62, No. 3, March 1955, pp. 178-179.

A tabulation of annual average indexes of comparative equipment cost for 8 process industries and 4 related industries from 1913 through 1954.

77. _____. Kiln Reactor Key to New Zirconia Process. Vol. 61, No. 11, November 1954, pp. 124-126.

Zirconium Corp. of America has developed a process to react zircon sand and dolomite in a rotary kiln to make zirconia. A new plant for producing this commodity has been built at Solon, Ohio (near Clevelend) at a cost of $250,000 and is producing 2,000 pounds per day. Production can easily be stepped up to 5,000 or 8,000 pounds per day.

78. _____. New MnO_2 Process Looms as Cost Cutter. Vol. 61, No. 10, October 1954, pp. 122-124.

A new process for high-grade manganese dioxide, now in 1,000 pound-per-hour pilot-plant stage, is being developed by E. S. Nossen Laboratories, Inc., Paterson, N. J. This process bypasses both conventional arc-dressing methods and high-cost electrolytic processes and takes a chemical tack to produce both Metallurgical grade and battery-active MnO_2 from domestic low-grade ores. The new process has captured the interest of the Government, whose General Services Administration financially backed the pilot-plant venture. Nossen Laboratories claim that this process requires an investment cost of only about one-sixth that of an electrolytic process for a plant of same capacity.

79. _____. New N^{15} Process Slashes Nuclear Costs. Vol. 63, No. 1, January 1956, p. 104.

A new method for producing cheap concentrated N^{15} may lead to wider use of economical thorium-type breeder reactors. Before this new method was devised, N^{15} was available at $175,000 per pound; under new method N^{15} can be made commercially at about $500 per pound.

80. _____. No Letup in Equipment Cost Rise. Vol. 63, No. 3, March 1956, pp. 194-195.

Marshall and Stevens Annual Indexes of Comparative Equipment Costs, 1913 to 1955, with accompanying graphs for 8 process industries and 4 related industries.

81. _____. Power From the Atom - It's Almost Here. Vol. 61, No. 9, September 1954, pp. 118-122.

Latest cost studies made prospects of commercial nuclear power look better than ever. Even heretofore conservative General Electric is venturing to predict cost of electricity from atom at about 6.7 to 6.8 mills per kilowatt-hour. Gives a good tabulation of the method G. E. uses for figuring cost of nuclear power. Article also describes various types of reactors preferred by companies leading the way in nuclear power development.

82. CHEMICAL ENGINEERING. $R \leqq (YSN - P - W)/r$. Vol. 62, No. 1, January 1955, p. 130.

Dr. Ralph H. Manley, managing directer of General Mills research laboratories, introduced a new formula designed to answer, at least in part, question of how much money chemical process industries should spend on research and development.

83. _____. 16th Biennial Materials of Construction Report. Part I - Survey of Materials. Vol. 61, No. 11, November 1954, pp. 172-201.

Materials of construction, such as high-silicon irons, stainless steels, cast high alloys, chlorimets, etc., are classified by composition, properties, forms and applications, etc. The most advantageous use for each material - costwise and performancewise - is also given.

84. _____. Slash Time for Estimating Drier Costs. Vol. 62, No. 2, February 1955, pp. 120-124.

Standard Steel Corp. estimates that a new system utilizing punch-card coding of engineering and cost data on rotary-drier installations and estimates saved the company over $10,000 in 1 year.

85. _____. To Figure Condenser Costs. Vol. 62, No. 3, March 1955, pp. 116-117.

A series of charts gives a set of figures that author believes accurate enough for process engineer to use for steam surface condensers in making preliminary cost estimates. A detailed explanation is given of charts and factors to consider in calculating condenser costs.

86. _____. Two-Effect Propane Evaporator Cuts Fuel Bill. Vol. 62, No. 10, October 1955, pp. 124-126.

A propane deasphalting unit, designed for a maximum oil-charge rate of 12,000 barrels per day and a propane circulation rate of 97,000 barrels per day, is being used at a petroleum refinery in Pernis, Netherlands. A savings in fuel - approaching 40 percent of that required for a single-stage system - and savings in cooling-water consumption are significant.

87. _____. You Can Cut Quality Control Costs - Safely. Vol. 63, No. 7, July 1956, pp. 264, 266, 268.

A survey by Warner-Chilcott Laboratories confirms that acquiring and maintaining quality raw material cost money. For example, Warner-Chilcott found that raw materials claimed 40 percent of the total quality control bill and came to two-thirds of the company allowance for warehousing overhead.

88. **CHEMICAL ENGINEERING COSTS QUARTERLY.** Average Hourly Earnings in the Chemical and Allied Products Industry.

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89. _____. Cost Literature, 1955. Vol. 6, No. 1, January 1956, pp. 17-27.

A bibliography of cost literature for 1955, classified by subject matter into 13 categories.

90. _____. Labor and Material Indexes.

Vol.	No.	Date	Page
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6	2	April 1956	31
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91. **CICHELLI, M. T., AND BRINN, M. S.** How to Design the Optimum Heat Exchanger - 15 Steps. Chem. Eng., vol. 63, No. 5, May 1956, pp. 196-200.

In an attempt to combat rising costs of heat exchangers, authors have developed simplifying questions for getting economical optimum design for shell-and-tube heat exchangers.

92. **CLARK, W. C.** Wound-Rotor Motors Reduce Power Costs. Oil Gas Jour., vol. 54, No. 87, Dec. 31, 1956, pp. 215-217.

Discusses advantages of wound-rotor motor drives and describes first installation of such drives in 1935. Gives general review of economics of wound-rotor installation with particular emphasis on reduced power costs.

93. **CLARK, W. G.** Tank Foundations. Cost Eng., vol. 1, No. 1, July 1956, pp. 12-18.

Discusses types of foundations and factors to consider in estimating costs. Actual labor rates and material costs from Pittsburg, Calif. area were cited and used in estimating costs of various types of foundations. Sketches of each foundation are presented, as well as material and labor requirements for each.

94. CLIFCORN, L. E. The Food Industry's Attitude Toward Radiation Sterilization. Nucleonics., vol. 13, No. 1, January 1955, pp. 39-40.

Economics and technical feasibility are given for radiation processing of foodstuffs.

95. COLLETT, M. S. Sharing a Microwave System. Oil Gas Jour., vol. 53, No. 29, Nov. 22, 1954, pp. 78-80.

Describes joint construction and operation of a microwave system to overcome high initial costs of such a system. To construct an average system costs approximately $1,200 a mile and approximately $170 a mile per year to operate. It was estimated that joint system could be constructed for about 60 percent of cost for two independent systems. Lower maintenance costs are also an advantage of a joint system. Two independent systems would require at least a total of 6 technicians, while joint system requires only 4.

96. COOK, L. H. Urea. Chem. Eng. Prog., vol. 50, No. 7, July 1954, pp. 327-331.

New Chemico process is compared with six other processes: Once-through, hot-gas recycle, solution recycle, Pechiney, Inventa, and Montecatini. Urea plant investments reported in the literature range from $12,000 to $30,000 per daily ton, varying with process used, plant capacity, and plant location. Investment required for a complete recycle Chemico plant capable of producing 150 tons of bagged urea per day is approximately $20,000 per daily ton or $3,000,000. This includes an erected plant with all necessary process equipment, instruments and controls, utility piping and controls, and buildings and foundations, as well as paidup royalties, training of operating personnel, and supervision of initial startup.

97. CRITES, G. JEWETT. Vacuum Drying. Chem. Eng. Costs Quart., vol. 6, No. 1, January 1956, pp. 4-10.

Types of vacuum driers are described and costs and specifications are given for the various models of each type.

98. CROES, J. A. Cost of Centrifugal Pumps. Chem. Eng. Costs Quart., vol. 4, No. 4, October 1954, pp. 93-110.

Describes centrifugal pumps, including types of impellers and stuffing boxes. Factors influencing pump selection, materials of construction, and design limitations are also discussed. Tables present dollar cost of three different types of pumps of varying sizes and horsepower; additional cost for mechanical seals attached to three types of pumps is also tabulated.

99. CROMWELL, C. E. When to Replace a Pump. Petrol. Refiner, vol. 33, No. 9, September 1954, pp. 300-302.

Presents a chart for calculating power costs savings and capitalization costs. Three examples of replacing pumps are give, with savings realized.

D

100. DANIELS, FARRINGTON. Small Gas Reactor Offers Economic Promise. Nucleonics, vol. 14, No. 3, March 1956, pp. 34-41.

Gives general description, including advantages and disadvantages and cost data for a small gas-cycle reactor.

101. DAVIDSON, R. C., SHUTE, R. S., AND SECOR, R. B. Maximum Yield of Catalytic Naphthas. Oil Gas Jour., vol. 54, No. 57, June 4, 1956, pp. 81-85.

Discusses importance of obtaining maximum yield of naphtha from a catalytic cracking unit to realize a slight gain in octane number and a significant economic advantage. By curves and tabulations catalyst comparisons are made that reveal economic value of a makeup rate program. In this particular study an actual octane benefit was realized, as well as an additional income of approximately 20 cents per barrel of catalytic gasoline.

102. DAVIDSON, ROBERT L. How Computers Can Help You. Tower Cost Estimating. Petrol. Proc., vol. 11, No. 6, June 1956, pp. 61-64.

Shows how to calculate tower costs by use of card programed calculators.

103. DAVIS, HAROLD S. How to Choose and Place Mixes for High-Density Concrete Reactor Shields. Nucleonics, vol. 13, No. 6, June 1955, pp. 60-65.

Tells how high-density concrete can be designed and placed at lowest cost.

104. DAVIS, W. KENNETH. Power-Reactor Development in the United States. Mines Mag. (Colo.), vol. 45, No. 8, August 1955, pp. 30-33, 48.

Summarizes power-reactor development program in United States, Canada, and Great Britain. Briefly touches on costs of power from nuclear reactors.

105. DEEGAN, CHARLES J. Do You Know How to Figure When Pressure Maintenance Pays Off? Oil Gas Jour., vol. 53, No. 13, Aug. 2, 1954, pp. 100-102.

To evaluate economics of pressure maintenance, example is given showing how to compare investment for a theoretical project where two alternatives are proposed.

106. DEERING, ROBERT G. Today's Biggest Transportation Value. Oil Gas Jour., vol. 54, No. 23, Oct. 10, 1955, pp. 151-155.

Comparison of pipeline rates with other forms of oil transportation - truck, rail, tankers and barges. For example, one outstanding comparison is the pipeline rate of 64 cents per barrel from Edmonton, Alberta, into Sarnia, Ontario, as compared with the railroad rate of $7.02 per barrel.

107. DERICKSON, GAYDEN. It Pays to Organize. Petrol. Refiner, vol. 35, No. 11, November 1956, pp. 183-184.

A company-wide corrosion organization making a unified effort can contribute to a valuable reduction in corrosion costs. In one instance the integrated effort of such a group resulted in a 40-percent reduction in painting costs, and coating service life is now 3 to 5 times greater.

108. DERMODY, J. L. Cost of Colloidair Separators. Chem. Eng. Costs Quart., vol. 4, No. 3, July 1954, pp. 82-85.

A description, including flow diagram, of the Colloidair Process and presentation of basic cost data that can be used for estimating cost of a particular dissolved air-flotation system. Depreciation, operating costs, and maintenance are briefly discussed.

109. DERUNGS, W. A. Controlled Corrosion Cuts Costs. Petrol. Refiner, vol. 35, No. 9, September 1956, pp. 319-322.

By modifying operating conditions, especially by restricting maximum operating temperature and making use of an adequate neutralization system, the N. V. De Bataafsche Petroleum Maatschappij of the Royal Dutch/Shell Group was able to utilize unalloyed steel to a greater extent in processing high-sulfur crudes, thereby reducing need for costly corrosion-resistant alloys.

110. DeSIMONE, RALPH E. Controlling Costs in Construction. Chem. Eng. Prog., vol. 50, No. 8, August 1954, pp. 379-381.

Discusses factors to consider in controlling construction costs in two different phases, namely, the precontract phase and the construction phase.

111. DILTZ, JACK L. Mixing Equipment. Chem. Eng. Costs Quart., vol. 6, No. 2, April 1956, pp. 42-49.

Factors to consider in selecting mixing equipment are listed, and costs, as well as some descriptive information, are given for pony mixers, ribbon mixers, three-roll mills, and double-arm mixers.

112. DOCKENDORFF, R. L. Humble's Dry-Air System Proves Its Worth. Oil Gas Jour., vol. 54, No. 3, May 23, 1955, p. 139.

Presents summary of actual investment cost in 1947-48 for an instrument-air system and investments in subsequent years to increase the capacity of the system to 3,400 std.c.f.m. of dry air and to make it available to all the units.

Total investments in facilities	$59,000
Total supplementary investment	53,200

Total cost of present facilities is about $85.00 per std.c.f.m.

113. DOEDE, C. M., AND WALKER, C. A. Photochemical Engineering. Chem. Eng., vol. 62, No. 2, February 1955, pp. 159-178.

A thorough review of subject is given in this six-part article. Part V discusses energy and overall cost factors to consider in determining economic feasibility of photochemical activation.

114. DOWNS, GEORGE F., JR., AND TAIT, GEORGE R. Formulas for Selecting Pipeline Diameter for Minimum Investment. Petrol. Eng., Ref. Ann., vol. 26, No. 8, 1954, pp. D-12 - D-19.

This paper discusses derivation and use of formulas which, when solved, give size of pipeline required for transporting given quantities of liquid petroleum products at minimum investment. Formulas take into account the cost of the pipeline, cost of pumping equipment, and quantity and physical properties of the flow to be handled. These variables are expressed as a function of pipeline diameter so that, when proper values are assigned to them, the optimum size of the pipe for the minimum investment may be determined. Alinement charts or nomographs are included to aid in solving two of the formulas. The paper briefly discusses some pipeline flow formulas now in use. Examples are given of several typical solutions. Generalized cost information is illustrated.

115. DUFF, BARRETT S. Ammonia - What Does It Cost to Make? Petrol. Proc., vol. 10, no. 2, February 1955, pp. 223-228.

Discusses production of ammonia by several processes and gives cost figures.

116. _____. Economics of Ammonia Manufacture From Several Raw Materials. Chem. Eng. Prog., vol. 51, No. 1, January 1955, pp. 12-J - 16-J.

Compares costs of manufacturing 100 and 200 tons per stream-day of anhydrous ammonia with hydrogen obtained from natural gas, from residual oils, from coal, from coke-oven gas, and from refinery catalytic-reformer offgas. Operating requirements for the 5 cases are summarized and a recapitulation of investment and manufacturing costs for 5 raw materials is given.

117. DUFFEY, H. R., AND WELLS, P. A., JR. Economics of Furfural Production. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1408-1411.

Discusses status of furfural production with respect to raw material sources, production capacities, competitive status, and European vs. United States conditions for profitable operations. Furfural plants have been built at costs ranging from 10 cents per pound of product per year to 35 cents per pound of product per year. In any event, furfural plants are large, expensive installations and cannot be moved to new locations if local raw materials for furfural become unavailable.

118. DUNWOODY, W. B., AND PHILLIPS, J. R. More Ammonia With Least Investment. Petrol. Refiner, vol. 35, No. 12, December 1956, pp. 169-171.

Mississippi Chem. Corp. has added the second-stage CO_2 conversion and low-pressure methanation units to its existing plant producing anhydrous ammonia. This modification has resulted in a process that increased ammonia production 20 percent and lowered investment in purification equipment and gas-compression equipment. The following table is a cost comparison of the original plant and the modified plant.

	Plant investment/annual ton of ammonia produced (approx. 123 T/D)
Original	$123/ton for 120 T/D produced
Modified	$103/ton for 160 T/D produced

Operating costs, including fixed charges, for this additional ammonia capacity are less than $20 per ton.

E

119. ECKHOUSE, J. G., GERALD, C. F., AND DeROSSET, A. J. Progress Report...Unifining Upgrades Distillate Fuels. Oil Gas Jour., vol. 53, No. 17, Aug. 30, 1954, pp. 81-83.

A previous article[6/] presented process description, flowsheet, chemistry of process, and results from treating a number of different stocks. This article presents additional information on upgrading middle distillates.

While this is considered a relatively low-cost catalytic process from standpoint of operating and investment costs, the economics of this application will vary from one refiner to another. Two curves plot gross product value vs. weight-percent coke for catalytic cracking of heavy cycle oils and light cycle oils before and after using the Unifining process. Based on certain assumptions and on product values used, a gross differential profit of about 27 cents per barrel for heavy cycle oil and about 17 cents per barrel for light cycle oil is calculated, thus representing payout times on investment of less than two years.

120. EGLOFF, GUSTAV. Symposium on "Know-How" Economics. Process Know-How Through Licensing. Ind. Eng. Chem., vol. 47, No. 5, May 1955, pp. 990-992.

Discusses advantages of process licensing and cost to the licensee. Cost of licensing a process as compared with a company conducting its own research and development laboratory illustrated by several examples.

121. EICKMEYER, A. G., AND MARSHALL, W. H., JR. Ammonia Synthesis-Gas Regeneration by Pressure Reforming of Natural Gas. Chem. Eng. Prog., vol. 51, No. 9, September 1955, pp. 418-421.

A general description of low-pressure reforming to generate synthesis gas - reasons for its use and its limitations - and manufacturing costs of ammonia when this process is employed.

122. ELAM, JOSEPH B. Pipeline Cost Estimating. Oil Gas Jour., vol. 54, No. 23, Oct. 10, 1955, pp. 139-145.

To assist cost estimator in utilizing his collection of available data to greatest possible degree, one firm has prepared a handbook compiling valuable information accumulated in various departmental personnel files. Book is divided into three sections: (1) An introduction and discussion of The Economic Study, (2) Construction Cost Estimating, and (3) Operating Cost Estimating. An outline of each section is presented with a brief description of salient points in each.

123. ENRIGHT, ROBERT J. Sweet Crude From Sour - Crude Fields. Oil Gas Jour., vol. 54, No. 53, May 7, 1956, pp. 84-85.

A new development to make sweet higher gravity crude oil from low-gravity, extremely sour oil is being considered by one independent operator and may well revolutionize the crude-oil-production industry. While it was not announced

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[6/] Grote, H. W., and Others. Unifining - A New Petroleum Process: Oil Gas Jour., vol. 52, No. 50, Apr. 19, 1954, p. 211.

what process will be used, it is believed that Hydrodesulfurization process is most likely possibility. Use of this process would require an investment of about $500 per barrel of daily capacity (for a 20,000-barrel unit), a direct operating cost of 25 cents per barrel, and a total operating cost of 50 cents per barrel.

124. **EPPARD, J. H., AND WINGARD, M. R.** Chemofining' - Petroleum's Future. Petrol. Proc., vol. 9, No. 7, July 1954, pp. 1070-1074.

Presents a detailed description of a hypothetical company which utilizes petroleum as a chemical source rather than as an energy source. Process steps are described briefly and include production figures, maintenance and operating costs, and a flow diagram.

125. **ERICSSON, RALPH L., AND JOHNSON, LESTER E.** Symposium on "Know-How" Economics. Costs in Developing Marketing Know-How. Ind. Eng. Chem., vol. 47, No. 5, May 1955, pp. 992-994.

Discusses marketing knowhow limited to three principal categories: 1. Marketing research - the costs of determining where markets are and what is their extent. 2. Market development - the costs of developing markets for new products and the extension of old products into new uses. 3. Direct sales - the cost of maintaining present markets and extending their volume.

Three tabulations covering the above categories are presented for companies classified as small, medium, and large.

F

126. **FAIRBANKS, W. J.** Better Estimates of Energy Needs. Oil Gas Jour., vol. 54, No. 14, Aug. 8, 1955, pp. 91-94.

Describes improved formulas and methods developed by Shell Oil Co. to estimate best size of electric motors and energy requirements for pumping units, with ultimate result that a saving of $40 to $200 per well in investment cost has been realized.

127. **FAIRCLOUGH, HUGH.** What Price Hydrogen? Petrol. Refiner, vol. 35, No. 9, September 1956, pp. 233-235.

Four figures give investment and production costs for plant producing 15 thousand to 16 million std. c.f.d. of H_2. These cost data are intended for use in making only preliminary comparisons of processes. Seven processes are compared, including electrolysis of water, steam-methanol, ammonia dissociation, steam-iron, reforming natural gas or propane, partial combustion of natural gas or fuel oil, and refinery offgas.

128. **FAIRLESS, BENJAMIN F.** The Perfect Price. Petrol. Eng., vol. 28, No. 2, February 1956, pp. A-10 - A-11.

Discusses basic economics, importance of price in relation to costs, and best way to arrive at perfect price.

129. **FARRAR, GERALD L.** Are Diesel Fueld Better Than Necessary? Oil Gas Jour., vol. 54, No. 67, Aug. 13, 1956, pp. 113-115.

By using ASTM, statistics and manufacturers it is shown that current fuels are higher in octane number and lower in distillation range than necessary. Gives operating-costs comparison of distillate fuel and also calculates savings possible when a fuel of lower octane number and higher distillation range is used.

130. _____. Decarbonizing Process Improves Flexibility. Oil Gas Jour., vol. 53, No. 46, Mar. 21, 1955, pp. 205-207.

Discusses McMurrey Refining Company's decarbonizing unit at Tyler, Tex.; operating costs, including direct charges, taxes, insurance, administration and overhead, 15-year amortization, are approximately $0.12 per barrel of reduced crude charges.

131. _____. Flexibility in Refining Processes - 1. In Revamping Old Units.[7/] Oil Gas Jour., vol. 53, No. 9, July 5, 1954, pp. 130-132.

No actual costs are given but the steps involved in assembling a cost figure to determine the savings, if any, of revamping over a new-unit installation.

132. _____. Flexibility in Refining Processes - 2. In Refinery-Process Design.[8/] Oil Gas Jour., vol. 53, No. 9, July 5, 1954, pp. 133-135.

Discusses major broad categories for which flexibility in refining process design must be evaluated. Gives comparative data, including cost figures, for several situations, as follows: L. Sweet vs. Sour Crude - Gulf Coast Refinery; 2. Product Yield and Quality Flexibility (based on varying daily capacities); 3. Conventional vs. Combination Unit, Refinery Flexibility; 4. Reactor-Temperature Flexibility, and also presents a compressor cost study.

133. **FELDMAN, KARL T., AND OSBORN, RALPH J.** When Does a Corrosion Control Program Pay? Petrol. Eng., vol. 28, No. 9, August 1956, pp. D-45 - D-48.

Discusses how to make an economic evaluation of a corrosion-control program.

134. **FENNEMA, THAD S.** Practical Economics for Refinery Mechanical Engineers. Petrol. Eng., vol. 28, No. 13, December 1956, pp. C-3 - C-8.

Article shows how problems can be attacked in a logical, orderly manner to arrive at most practical and economic solution.

135. **FISKE, CHARLES E., AND MILLER, RALPH.** Economics of ADC Electrolytic Mercaptan Process. Petrol. Eng., vol. 26, No. 12, November 1954, pp. C-48 - C-55.

[7/] Black, J. M., Engineering Construction Considerations in Plant Revamp Work: Pres. at 125th meeting American Chemical Society, Kansas City, Mo., Mar. 23 - Apr. 1, 1954.

[8/] Packie, J. W., and Campbell, D. L., Flexibility in Refinery Process Design: Pres. at 125th meeting American Chemical Society, Kansas City, Mo., Mar. 23 - Apr. 1, 1954.

Describes process, equipment involved, and effectiveness of method. Gives some cost data.

136. **FLEER, A. W., JOHNSON, A. J., AND NELSON, C. R.** Symposium on "Know-How" Economics. Importance of Know-How in Chemical Development. Ind. Eng. Chem., vol. 47, No. 5, May 1955, pp. 982-987.

Presents information to account for the rapid increase in industrial chemical research expenditures over past few years.

137. **FONTANA, MARS G.** Corrosion. Ind. Eng. Chem., vol. 47, No. 10, October 1955, p. 81A.

Use of hydrazine as a corrosion inhibitor and O_2 scavenger in treating boiler feedwaters has been found less costly than sodium sulfite, even though hydrazine is more expensive per pound. Annual savings of $200 and $425 were realized by two different plants substituting hydrazine for sodium sulfite.

138. **FORBATH, T. P., AND GAFFNEY, B. J.** Acetylene by the BASF Process. Petrol. Refiner, vol. 33, No. 12, December 1954, pp. 160-165.

Discusses commercial process based on partial oxidation of natural gas with oxygen. Includes investment and operating costs.

139. **FORBES, J. J.** Developments in Synthetic Liquid Fuels. Mines Mag. (Colo.), vol. 44, No. 11, November 1954, pp. 111-114, 158.

Summarizes Bureau of Mines position on further investigations of synthetic liquid fuels production. Touches on some highlights of Bureau programs to date. Brief cost figures are given for producing gasoline from oil shale and from coal.

140. **FORBES, M. C.** An Economic Analysis of Water Treatment. Petrol. Eng., vol. 27, No. 10, September 1955, pp. C-34 - C-41.

Various water treatment processes are discussed and cost figures given for a typical gasoline plant. Graphs show installed costs of various types of water softeners and costs of chemicals used in each type.

141. _____. Cooling Water Filters Save Money. Petrol. Refiner, vol. 35, No. 4, April 1956, pp. 185-187.

Illustrates how to estimate cost and how to select right-size filter.

142. **FORD, S. D.** How to Design a Gas Pipeline. Oil Gas Jour., vol. 54, No. 32, Dec. 12, 1955, pp. 106-110.

Step-by-step description of a method for designing safe, economical pipelines. To illustrate method described, author assumes a problem and then compares transportation cost of three different pipeline designs to arrive at selection of proper design.

143. **FRIEND, L., AND LEMIEUX, E. J.** Perforated Trays. Oil Gas. Jour., vol. 54, No. 64, July 23, 1956, pp. 88, 90-92.

Based on a development program begun in 1949, one company is now using perforated trays instead of bubble-cap trays whenever practicable. Its experience has shown that perforated trays cost 9.8 to 28.4 percent less than bubble-cap trays, and performance is equal, if not better, in some instances. Presents a curve giving comparative costs for both types of trays in 18 typical cases.

144. FULLER, JOE R. Eight Dollar-Saving Tips to Keep Construction Costs Down. Petrol. Proc., vol. 9, No. 8, August 1954, pp. 1212-1215.

Lists ways to save on construction costs and discusses each item in light of actual experience.

145. FUNK, WILLIAM H. When to Use the Alloy Steels. Petrol. Eng., vol. 10, No. 9, September 1955, pp. 1365-1367.

Tables give cost per square foot for pressure vessel shell for ASTM carbon and alloy steels; also give comparison of steels at various maximum service temperatures.

G

146. GAFFNEY, BERNARD J. Econograph - for Fast Cost Analysis. Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 111-115.

Development of a special type of nomograph that permits a comprehensive picture of economics of a plant venture. Use of graph is described and then cost equations derived to permit construction of an Econograph.

147. GALLAGHER, GLEN G. Trends in Modern Instrumentation. Petrol. Eng., Ref. Ann., vol. 26, No. 8, July 15, 1954, pp. C-56 - C-61.

Discusses trends in petroleum-refining instrumentation. Brief cost comparison for conventional and graphic panels included.

148. GARTEN, J. P. New Wrinkles in Hot-Oil Washing. Oil Gas Jour., vol. 53, No. 29, Nov. 22, 1954, pp. 93-95.

A comparison between hot-oil washing method and Wilmington cold-oil washing method from aspects of both operation and cost. An economic return of $8.45 for each dollar expended was realized in one washing program using hot-oil method. Net profit on this same program was $127,810, a substantial return for $15,122 invested.

149. GASTON, AL., Here's a Fast Way to Seal Water-Storage Ponds. Oil Gas Jour., vol. 54, No. 53, May 7, 1956, pp. 136-137.

Describes a method of lining treating ponds with prefabricated asphalt membrane to make them impermeable. Installed cost of 1/2-inch linings ranges between 25 and 28 cents per square foot, which is much lower than cost of monolithic structures.

150. GILL, JOSEPH P. Design for a High-Performance Research Reactor. Nucleonics, vol. 12, No. 9, September 1954, pp. 36-38.

Gives general design data and estimated costs for a "high-performance" research reactor.

151. **GILLILAND, E. R.** Fresh Water for the Future. Ind. Eng. Chem., vol. 47, No. 12, December 1955, pp. 2410-2422.

Although there is no indication that the total "fresh" water in the world is inadequate, water is not always available when and where it is needed. Supplying water to any land area can be done, but whether it is done or how is a matter of cost. A table presents costs of water consumed and the estimated cost of producing water from sea water and brackish water, based on size of installation. Several processes for producing water from sea water and brackish water are discussed and estimated costs given.

152. **GILMORE, JOHN F.** Estimate Tomorrow's Costs From Today's Records. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 175-180.

Commenting on the fact that too often cost records are maintained for legal purposes - taxes, insurance, debt, etc. - without thought to their value to the cost estimator, the author discusses the three most important tools in a system of cost accumulation. These tools are (1) the Final Summary Form, (2) the Equipment Item List, and (3) the Code of Accounts. The application of these tools is explained and illustrations of each are shown.

153. **GIVENS, HOMER C., AND CUSTER, ROBERT.** Cold Lime-Alum Softener Lowers Costs $35 a Day. Petrol. Refiner, vol. 34, No. 8, August 1955, pp. 137-139.

Describes a 2-year-old water softening unit of 1 million gallons per day capacity with an investment of about $50,000. Payout expected in less than 3 years.

154. **GLAVZ, ROY L., JR.** Estimating Maintenance Costs for New Plants. Chem. Eng. Prog., vol. 51, No. 3, March 1955, pp. 122-125.

Briefly describes the four available methods for estimating repair costs and suggests that greater estimating accuracy can be obtained by employing a variation of the percent of the investment approach. Instead of applying a percentage against the entire plant investment, the latter is broken down into various major unit operations, thus permitting a more accurate estimate. Graphs of repair costs vs. investment for eight unit operations are presented, and these are then summarized graphically.

155. **GORDON, J. A.** Crude-Oil Absorption Clicks With Union. Oil Gas Jour., vol. 53, No. 27, Nov. 8, 1954, pp. 175-177.

Describes crude-oil absorption process and includes operational data for Union Oil's crude-oil absorption plant. Lists conditions to consider in selecting this process over others, and in discussing economic factor there is a comparison of costs required to treat 5,000 M c.f.d.

156. **GRIFFIN, G. M., AND OTHERS.** Caustic Soda: Liquid is Up-Up-Up. Ind. Eng. Chem., vol. 48, No. 5, May 1956, pp. 7A-10A.

Discusses trend toward liquid caustic and economics underlying trend.

Part of costly evaporation and drying operation is avoided in liquid material cost. Actual prices for various forms of anhydrous caustic (f.o.b. producer's plant) illustrate lower cost of liquid:

	Cwt., 100% basis
Solid caustic	$4.10
Flake caustic	4.50
Caustic liquor (73%)	2.90
Caustic liquor (50%)	2.80

Recent prices for material delivered in Louisville (Ky.) area show the difference, even with freight costs included:

		Cwt., 100% basis
Solid caustic	carloads	$4.40
Flake caustic	do.	4.80
Solid caustic	truckloads	4.72
Flake caustic	do.	5.12
Solid caustic	l.c.l.	5.79
Flake caustic	do.	6.19
Caustic liquor (73%), tank cars		3.32
Caustic liquor (50%), tank cars		3.46
Caustic liquor (50%), tank wagon		4.25

157. GROPPE, HENRY. Trends in the Expansion of the Chemical Industry. Chem. Eng. Prog., vol. 51, No. 2, February 1955, pp. 81-F - 84-F.

Expansion of the petrochemical industry in recent years is evidenced by the fact that in 1953 over 50 percent (slightly over $3 billion) of estimated total chemical-plant investment was represented by petrochemicals.

While predominance of petrochemical plants has been on the Gulf coast, recent trends in the cost of natural gas, transportation, water, etc., show a decreasing advantage to this area as a plant site and are reflected in comparative cost data.

158. GROTE, H. W., HAENSEL, V., AND STERBA, M. J. Rexforming - Its Product Will Meet any Motor-Fuel Needs Now in Sight. Oil Gas Jour., vol. 53, No. 48, Apr. 4, 1955, pp. 233-236, 239.

Describes Rexforming process in detail and presents a flowsheet and curves illustrating various steps in its operation. An economic summary is given for a plant charging 5,000 barrels per day of Mid-Continent fuel-boiling straight-run gasoline and producing 101 F-1 clear Rexformate. The erected cost for such a plant would be approximately $1,600,000; the process costs about $300 per barrel to install and about 36 cents per barrel to operate.

159. GUMAER, R. R., AND RAIFORD, L. L. How First Ultraformer Has Performed. Oil Gas Jour., vol. 54, No. 14, Aug. 8, 1955, pp. 119, 121, 123.

Discusses results of 1 year's operation of world's first Ultraformer at Pan-Am. Southern's El Dorado (Ark.) refinery. Discusses process, reactions, operating conditions, performance, flow, and yield data. Assuming a catalyst life of 100 barrels per pound processing costs are as follows:

	Cents/bbl. of charge
Operating labor and supervision (including benefits)	3.8
Maintenance and repairs	2.5
Utilities	7.2
Catalyst	4.0
Miscellaneous	.3
Total	17.8

160. **GUTHRIE, V. B.** For Petrochemicals - Things are Picking Up. Petrol. Proc., vol. 10, No. 9, September 1955, pp. 1387-1390.

Evaluation of petrochemicals industry and outlook.

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161. **HACKNEY, JOHN W.** An Outline of Capital Cost Estimating. Cost Eng., vol. 1, No. 2, October 1956, pp. 27-39.

Discusses capital cost estimating as a phase of cost Engineering, including importance of good estimates, factors affecting accuracy in estimating, and some suggestions for preparation and use of cost records.

162. **HAFSTAD, LAWRENCE R.** How Will Nuclear Power Affect Your Customers? Mines Mag. (Colo.), vol. 45, No. 1, January 1955, pp. 25-28, 50.

Discusses power demand and fuel supply in general. Discusses also use of nuclear power in some detail and includes some investment costs for several sizes of power reactors, both commercial and experimental.

163. **HAINES, HARVEY W., AND JOYNER, LESLIE G.** A Staff-Industry Collaborative Report. Ind. Eng. Chem., vol. 47, No. 2, February 1955, pp. 178-186.

Discusses processing used by Godchaux Sugars, Inc., in producing calcium-magnesium aconitate from molasses; includes a brief summary of manufacturing costs.

164. **HALE, DEAN.** Coal Commutes From Cadiz to Clevelend. Petrol. Eng., vol. 28, No. 10, September 1956, pp. D-20 - D-24.

Describes long-distance pipeline for transporting crushed coal in slurry form. Describes economics of operation.

165. **HAMMER, HAROLD HARLAN.** The ABC's of Oil Payments. Petrol. Eng., vol. 26, No. 12, December 1954, pp. A-43 - A-46.

Discusses a plan for financing oil and gas properties, liquidating loans on them, and figuring best tax treatment for seller and buyer.

166. HANGS, FRANK E. The Easy Way.....Cost of Gas vs. Oil Fuels. Petrol. Refiner, vol. 34, No. 8, August 1955, p. 140.

A nomograph entitled "Gas and Oil Fuels Cost Comparisons for Industrial Purposes."

167. HAPPEL, JOHN. The Venture Worth Method for Economic Balances in Chemical Engineering. Chem. Eng. Prog., vol. 51, No. 12, December 1955, pp. 533-539.

Because of the many intangibles involved in arriving at an economic balance, author presents what he believes a concise method for applying certain general principles to problem of a satisfactory financial return on a chemical engineering investment.

168. HARDY, WALTER L. Benzene Hexachloride Manufacture. Ind. Eng. Chem., vol. 48, No. 10, October 1956, pp. 41A-42A.

The economics of a plant producing 5 tons of 25-percent gamma BHC per 24-hour day is discussed, with accompanying cost estimates. Estimated investment cost for such a plant is $565,000, and the estimated production cost per day $300.54. Return on investment is estimated to be about 13 percent per year before taxes.

169. _____. Costs of Producing Sodium Cyanide. Ind. Eng. Chem., vol. 48, No. 12, December 1956, pp. 41A-42A.

Material-balances and comparative costs are presented for two methods of producing sodium cyanide, that is, the metallic sodium process and the sodium carbonate method. Costs are summarized as follows:

	Metallic sodium	Sodium carbonate
Raw material cost/ton of sodium cyanide	$208.00	$122.00
Net raw material cost/ton of sodium cyanide	203.00	107.00
Total erected plant cost (3 tons of sodium cyanide/day)	119,000	174,500
Production cost/lb. of sodium cyanide (3 tons of sodium cyanide/day, 24 hr./day and 260 days/year)	0.1555	0.1346

170. _____. Costs - Process and Construction. Ind. Eng. Chem., vol. 47, No. 6, June 1955, pp. 79A-80A, 82A.

Discusses use of stainless steel in plant piping systems and its useful applications. Brief tabulation compares 2-, 3-, 4-inch black iron pipe with 3 thicknesses of stainless-steel pipe of same diameter sizes to cost per foot, minimum random lengths. Also gives graph showing cost of iron pipe size (IPS) butt welding long-radius elbows. Another graph shows relative cost of typical piping section. Several suggestions are given for ways to reduce steel piping costs.

171. _____. Costs - Process and Construction. Ind. Eng. Chem., vol. 47, No. 8, August 1955, pp. 79A-81A.

Discusses engineering and economic factors to be considered in design of a plant producing soluble coffee. A flow diagram is given for such a plant, and a graph showing both erected cost and equipment cost for plants of varying capacities is presented. A second graph shows processing costs per pound of soluble coffee for plants of different capacities, excluding raw coffee and packaging costs. A cost analysis for a plant producing 400 pounds of product per hour, based on 24-hour-per-day, 260-day operation per year, gives a processing cost per pound of $0.070.

172. HARDY, WALTER L. Costs - Process and Construction. Ind. Eng. Chem., vol. 47, No. 10, October 1955, pp. 73A-74A.

An analysis of spray drying cost shows that labor is the largest item, while utilities remain constant. Cost of a complete production spray drying unit, including all necessary pumps, blowers, instrumentation and other auxiliary equipment, will vary from about $20,000 for a small concurrent pressure nozzle unit to as much as $250,000 for largest available drier. Installation costs will vary from 60 percent of equipment cost for smaller units to 25 percent for large driers.

173. _____. Costs - Process and Construction. Ind. Eng. Chem., vol. 47, No. 12, December 1955, pp. 63A-66A.

Author selected refining of peanut oil as representative of type of processing and equipment in vegetable-oil industry. A process flow diagram of a peanut-oil plant is shown. Estimated investment cost of 2 plants, 1 producing 220 pounds per hour and the other producing 500 pounds per hour, is $168,100 and $244,400, respectively. Estimated production cost for same 2 plants on a 24-hour basis, 260 days per year, is $369.99 per day and $490.97 per day, respectively. Estimated production cost per pound of product is $0.07 and $0.041.

174. _____. Costs - Process and Construction. Ind. Eng. Chem., vol. 48, No. 2, February 1956, pp. 77A-79A.

Presents a flow diagram of a small-scale DDT plant and 3 tables that show the material requirements and costs, the estimated total plant investments for plants designed to produce 1, 3, and 5 tons of DDT per 8-hour day, and the estimated production costs. These compiled costs are as follows:

Cost of raw materials: $0.1968/lb. of DDT

	1-T/D	3-T/D	5-T/D
Total plant investment (excluding building and site):	$112,500	$190,900	$289,000
Total estimated production cost per day:	$158.17	$251.65	$339.33
Total cost of packaged product before profits:	$0.2824	$0.2453	$0.2372

175. HARDY, WALTER L. Costs - Process and Construction. Ind. Eng. Chem., vol. 48, No. 4, April 1956, pp. 79A-81A.

In a previous article dealing with economics of DDT manufacture, author showed that cost of chloral constitutes 35 to 45 percent of total packaging and production cost before profit. Any decrease in chloral cost would therefore have a significant effect on profits. For this reason, it is often justifiable, where the scale of production is great enough to bring production cost below the market price of 21 cents, to erect a chloral plant. Author discusses criteria to consider in such a case.

Material requirements, byproducts, and costs are tabulated (adjusted raw material cost $0.0705), as well as estimated investment cost and estimated production per day.

	20,400 lb./mo.	61,200 lb./mo.	102,000 lb./mo.
Raw-material cost	$0.0705	$0.0705	$0.0705
Total plant investment (24 hr./day, 250 days/yr.)	$79,400	$107,000	$159,300
Est'd production cost/day (24 hr./day, 250 days/yr. 1 full 8-hr. shift, 1 man only on night shifts)	$0.2175	$0.1331	$0.1193

176. _____. Costs - Process and Construction. Ind. Eng. Chem., vol. 48, No. 6, June 1956, pp. 83A-84A.

Because of increased American investments in foreign countries, author prepared data on foreign labor rates in the following categories: Chemicals, construction, food, and the mining, transportation, manufacturing, and service industries.

Author states that if enough interest is evidenced in such data, this information will be brought up to date yearly.

177. _____. Fertilizer-Plant Costs. Ind. Eng. Chem., vol. 48, No. 11, November 1956, pp. 41A-42A.

Discussion of economics of a batch superphosphate plant, including flow diagrams and cost estimates. Raw-material cost is $12.15 per ton of product, processing cost is $2.64 per ton, equaling a total production cost of $14.79. A plant producing 20 tons per hour would realize a gross profit of $580 per day (at current selling price of $16 per bulk ton of superphosphate), or $145,000 per year. Total installed cost of such a plant would be $800,000.

178. _____. Phenol-Formaldehyde Resin Manufacture. Ind. Eng. Chem., vol. 48, No. 9, pt. I, September 1956, pp. 45A-46A.

Discusses economics of phenol-formaldehyde resin manufacture, including a flowsheet for production of molding powder and cast resin product. Plant detailed in article is based on the "one-stage" operation to produce both cast products and molding powders.

A material balance is given with costs shown for pound of raw material and for pound of product. Cost per pound of product for cast resin is $0.2054 and $0.0184 for molding powder. Estimated plant-investment cost (based on 8-hour day, 250-day-per-year operation and on 6,650-pound-per-day production of cast resin and 26,700 pounds per day of molding powder) is $269,665, exclusive of buildings and site. Using the aforementioned production figures, the cost per 8-hour day is $1091.65, exclusive of raw materials. Cost per pound of product per day on a proportional basis is $0.2990 for cast resin and $0.1674 for molding powder.

An estimated balance sheet shows an annual gross income of $2,635,000 and annual expenses of $1,618,000, resulting in a net income of $1,017,000.

179. HARRIS, WILLIAM B., AND MASON, MONT. G. Operating Economics of Air-Cleaning Equipment Utilizing the Reverse Jet Principle. Ind. Eng. Chem., vol. 47, No. 12, December 1955, pp. 2423-2425.

Authors investigated use of reverse jet air-cleaning equipment to overcome deficiencies of conventional equipment. Experience gained from installing 18 collectors is described, and maintenance costs and routine maintenance problems are discussed. Based on 14 well-designed machines operating costs are $1,300, maintenance costs are $3,900, and amortization is $16,600, or $0.256 per year per c.f.m.

180. HARTECK, P., AND DONDES, S. Producing Chemicals With Reactor Radiations. Nucleonics, vol. 14, No. 7, July 1956, pp. 22-25.

Discusses technology and economics of use of reactors for producing chemicals.

181. HASS, H. B., AND LAMBORN, ODY H. Economics of Sucrose. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1392-1397.

Discusses opportunities in sugar as a cheap and abundant raw material for industrial organic syntheses.

A comparative tabulation shows that sugar is cheapest energy food, for example:

Food	Calories/lb.	Retail price, cts./lb.	Calories/ct.
Sugar	1,748	10.5	166
Potatoes	318	4.9	65
Round steak	829	89.9	9
Celery	52	12.7	4

Also gives the price of various forms of sugar, as of July 1954, and compares the cost of four other major organic starting materials.

182. HEIKE, E. A., AND OTHERS. Petroleum-Processing Problems. Petrol. Proc., vol. 10, No. 8, August 1955, pp. 1154-1156.

Last in a series of six articles summarizing comments by a 10-member regarding various petroleum-processing problems. One question deals with cost of producing butylene.

183. HEISING, L. F. Review of the Ammonia Industry and Its Application to North Dakota. Bureau of Mines Inf. Circ. 7697, 1954, 64 pp.

Report contains discussions of: (1) Materials used in manufacturing nitrogenous fertilizers, nitric acid, and urea; (2) national production, imports, exports, and consumption; (3) ammonia industry - location and capacity of plants; (4) processes used in manufacturing synthetic ammonia, nitric acid, and urea; (5) other potential industries; and (6) analyses of manufacturing and plant costs. Additional information on industrial compounds from ammonia and plant nutrients removed by crops is given in appendixes 1 and 2. Tables include: (1) Average wholesale prices per unit of 20 pounds of nitrogen in various materials at producing points or ports in bulk carlots since 1900; (2) capital costs and capacities of synthetic ammonia plants in operation in the United States; and (3) freight rates for railroad-tank-car shipments of anhydrous ammonia and manufactured nitrogen fertilizers.

184. HEISTER, NEVEN K., AND PHILLIPS, RUSSELL C. Ion Exchange. Chem. Eng., vol. 61, No. 10, October 1954, pp. 161-180.

Authors did extensive research on ion exchange. The trend of their article indicates that this much underrated and oft-neglected unit operation has a wide variety of applications that should be considered by chemical engineers.

Article outlines these applications and emphasizes its uses, beyond those presently applied, as a result of introducing continuous operation and electrodialysis. A table of operating and investment costs is given based on four methods: (1) Electrodialysis, (2) vapor compression distillation, (3) ion exchange, and (4) solar energy distillation. Another table gives the relative costs of evaporation vs. ion-exchange demineralization, and another shows the comparative costs of fixed- and moving-bed processes (based on 4-percent leakage).

185. HENDRYX, J. W. Packaged Compressors in Gasoline Plants. Oil Gas Jour., vol. 54, No. 36, Jan. 9, 1956, pp. 96-98.

Discusses advantages of a packaged compressor plant and presents a table showing various items of operational costs qualified and itemized.

186. HERMANN, E. C. How Esso' Field Coordinating Group Functions to Improve Refinery Maintenance. Oil Gas Jour., vol. 53, No. 27, Nov. 8, 1954, pp. 144-147.

Discusses organization and operation of maintenance personnel of Esso Standard Oil Co. at Bayway, N. J. Chart gives maintenance labor cost as percent of plant investment from January - December 1953. After reorganization in June the percentage went from 6.40 in January to 5.47 in December, whereas the predicted goal had been 6.10 percent.

187. HICKMAN, K. C. The Water-Conversion Problem. Energy Requirements and Standards. Ind. Eng. Chem., vol. 48, No. 4, April 1956, pp. 7A-20A.

Detailed appraisal of problem of water conversion in an attempt to crystallize situation and answer following questions: Where are we now? What are our existing potentialities? Is there something much better lurking, possibly just around the corner? Should we wait or proceed forthwith?

A summary of conversion process costs reveals that there is a minimum cost that is reasonable for producing large-scale new fresh water. However, present known processes must receive necessary degree of engineering development to bring about realization of (a) enabling existing coastal towns to be largely independent of mid-continental water, and (b) allowing town to come into existence where it is now not feasible because of unfavorable water supply.

188. HICKS, J. S., AND STEFFINS, L. R. Cost Estimating and Decision Making. Chem. Eng. Prog., vol. 52, No. 5, May 1956, pp. 191-194.

Function of cost estimates in deciding which of several available alternatives will most nearly achieve objective desired.

189. HILL, E. F., WILSON, G. R., AND STEINLE, E. C., JR. Production, Properties, and Uses of Fatty Alcohols. Ind. Eng. Chem., vol. 46, No. 9, September 1954, pp. 1917-1921.

Compares two commercial methods - hydrogenolysis and sodium reduction - for reducing fatty acids and esters to produce alcohols with unusual surface-active properties. Comparison is made with respect to raw materials, material balances, materials of construction, investment costs, labor and utility requirements, and quality of products.

190. HILL, R. D. What Petrochemical Plants Cost. Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 106-110.

Describes a quick, accurate method requiring only a flow diagram for estimating capital investment of a new process. This new method for quick estimating is compared with Wulff process (on which enough published data are available to permit a comparison) for a plant producing 20,000,000 pounds per year of 99.5-percent acetylene. Total fixed capital requirement based on Wulff process was $2,915,000; using newly devised "quick method" total fixed-capital requirement was $2,950,000.

Author also presents a quick method for preparing a summary of economics.

191. HILL, R. W. Redwood Steam Treaters Save Important Money. Oil Gas Jour., vol. 53, No. 21, Sept. 27, 1954, pp. 69-70.

Discusses actual savings realized by one company when it replaced conventional steel treaters with redwood-steam treaters. Costs with steel treaters had amounted to an average of $74 per month per treater or 1.7 cents per barrel of oil treated. Where indirect heater-redwood settling tanks were replaced with redwood-steam treaters, savings in scale-removing costs of $50 to $115 per month for each replacement resulted. A comparison of installed costs between steel treaters, indirect heater-settling tanks, and redwood-steam treaters of approximately the same capacity is given. A saving of approximately $23,140 has been effected in scale-removal costs with 13 redwood-steam treaters.

192. HOFFMAN, E. L. Paint Storage Tanks White and Save. Oil Gas Jour., vol. 54, No. 29, Nov. 21, 1955, pp. 241, 243, 245, 246, 249, 251, 253.

Discusses use of different-color paints and aluminum paint as compared with white paint to reduce evaporation losses. Tabulations are given showing results of tests made, and comparative cost data are presented. Type, methods, and cost of application are also discussed, including repainting costs. Many costs are quoted in cents per square foot.

193. HOLMES, VOLNEY M. Compare Engine Fuel Costs. Petrol. Refiner, vol. 35, No. 1, January 1956, p. 164.

Example problem is solved by using fuel-cost charts.

194. HORNADAY, GEORGE F. Dehydrogenation by the Houdry Process. Petrol. Eng., vol. 26, No. 12, November 1954, pp. C-7 - C-10.

Describes process and gives yield data, utility requirements, and economic factors.

195. HORNER, C., WINGER, A. G., BODAMER, G. W., AND KUNIN, R. Electrolytic Treatment of Waste Sulfate Pickle Liquor, Using Anion Exchange Membranes. Ind. Eng. Chem., vol. 47, No. 6, June 1955, pp. 1121-1129.

Discusses process in which sheets of anion exchange resins are used for recovering electrolytic iron and regeneration of sulfuric acid from waste sulfate pickle liquor. Various comparative costs are established through interpolation of accumulated data, and it is shown that a capital investment for continuous two-chembered cell is comparable to that for a lime neutralization plant, that is, $677,000.

196. HOVLAND, HAROLD. Better Quality, Lower Costs, Greater Production...Radiographic Inspection of Pipeline Welds. Petrol. Eng., vol. 26, No. 12, November 1954, pp. D-32 - D-39.

Results are given of a study of current pipeline-welding practices by the API-AGA Joint Committee on Oil and Gas Pipeline Field Welding Practices. Includes some cost figures for radiographic inspection.

197. _____. Radiographic Inspection Assures Sound Pipeline Welds. Oil Gas Jour., vol. 53, No. 28, Nov. 15, 1954, pp. 223-225, 228, 230.

Report of study of radiographic subcommittee of API-AGA Joint Committee on Oil and Gas Pipeline Field Welding Practices on extent of use of radiography for pipeline-weld inspection. Gives some costs of radiography in 1940, 1949, and 1950.

198. HUGE, E. C. Two Companies Report on How Additives Resulted in Better Burning, Less Corrosion, from Residual Fuel Oil. Oil Gas Jour., vol. 53, No. 11, July 19, 1954, pp. 90-92.

Discusses results obtained by two companies using additives in residual fuel oil to reduce low-temperature air-heater corrosion and facilitate ash removal from high-temperature correction surfaces of boilers. Brief cost comparison of cleaning boilers (1) without additives, (2) with alumina, and (3) with dolomite.

199. HULL, JOHN, AND TRICEBACK, DONALD. Cost of Rotameters. Chem. Eng. Costs Quart., vol. 4, No. 3, July 1954, pp. 66-81.

Describes types of rotameters and their applications, and selection and pricing of both primary and secondary instruments.

200. HULSE, R. E. Factors Entering Into Petrochemical Supply and Demand. Petrol. Refiner, vol. 33, No. 8, August 1954, pp. 139-142.

Article states that period of readjustment exists for petrochemical industry and presents a picture on short-range outlook, effect of integration on competitive positions of producers, and an insight into cost appraisal. Primarily concerned with marketing but gives new materials and comparative overall production costs for ethylene by integrated and nonintegrated companies.

201. HUNTER, E. E. How to Determine Gas-Production Cost. Oil Gas Jour., vol. 54, No. 12, July 25, 1955, pp. 219-221.

Describes a procedure developed by Humble Oil & Refining Co. for allocating gas-production cost, including various cost elements to consider and a table illustrating a hypothetical example employing method discussed.

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202. INDUSTRIAL AND ENGINEERING CHEMISTRY. Chemical Plant Construction Directory - 1955. Vol. 48, No. 1, January 1956, pp. 51A-63A.

Directory includes company and location of plant, cost in million dollars, products, and other pertinent remarks. A products index for plants listed in the directory is appended.

203. IRANI, M. G. Thorium as a Source of Nuclear Power. Mines Mag. (Colo.), vol. 45, No. 6, June 1955, p. 28.

Mentions announcement made by AEC in 1954 that thorium can breed more nuclear fuel than it consumes by using slow neutrons. Briefly discusses several such reactors and gives estimated costs.

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204. JACKSON, H. K., AND SADOWSKI, G. S. Design and Operation for Direct-Maintenance Fuel Separation. Nucleonics, vol. 13, No. 8, August 1955, pp. 22-25.

Gives investment and operating costs for a direct-maintenance solvent-extraction plant for irradiated reactor fuels.

205. JACKSON, J. O., AND BIGOS, JOSEPH. Correct Painting Methods Pay Dividends. Oil Gas Jour., vol. 54, No. 61, July 2, 1956, p. 121.

If petroleum refineries observe the following four factors in structural steel painting, large savings can be realized: (1) Proper design, (2) surface preparation, (3) correct application, selection, and (4) good formulation of paints. The economics of painting vs. corrosion allowance are discussed and the conclusions tabulated.[9]

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[9] Jackson, J. O., and Bigos, Joseph, Painting Costs Provide Maintenance Guide: Oil Gas Jour., vol. 54, No. 63, July 16, 1956, p. 121.

206. JELEN, F. C. By Using Capitalized Costs. Chem. Eng., vol. 62, No. 8, August 1955, pp. 181-188.

A discussion of the economics of replacement and the development of an exact mathematical relationship for replacement problems on the basis of capitalized cost. Several equations are given which can be used in computing the capitalized cost of replacement, and the author illustrates in detail the method of calculating the cost of replacement of an entire process unit.

207. _____. Consider Inflation in Comparative Cost Analyses. Chem. Eng., vol. 63, No. 5, May 1956, pp. 165-169.

How to include inflation as a factor in cost comparisons and effect it may have in preparing cost estimates.

208. _____. Watch Your Cost Analyses. Chem. Eng., vol. 63, No. 6, June 1956, pp. 247-252.

Author suggests a capitalized cost method to use in making cost analyses that will give proper consideration to inflation; presents seven illustrative examples.

209. JENIKE, ANDREW E. Better Design for Bulk Handling. Chem. Eng., vol. 61, No. 12, December 1954, pp. 175-180.

Author has developed a theory of solids flow that he believes should eventually enable solids handling designs to cut capital costs.

210. JOFFE, J. D. What Will Happen to These Earnings? Chem. Eng., vol. 62, No. 4, April 1955, pp. 195-198.

A new element, effect of changing economic conditions, is related to plant costs and return of investments. Author assumes three potential plants to illustrate significance of this neglected factor in cost estimating.

211. JOHNSON, E. C. Atomic Power. Mines Mag. (Colo.), vol. 45, No. 11, November 1954, p. 81.

Comments on how Atomic Power Bill enacted by Congress has inspired much interest in atomic power in private industry. Some cost figures are given.

212. JONES, E. L., PARKER, F. D., AND STROBEL, W. B. Petrochemical Profits From Refinery Cokes. Petrol. Eng., Ref. Ann., vol. 26, No. 8, July 15, 1954, pp. C-23 - C-28.

Included are: (1) Discussion of increased refinery profits due to coking; (2) description of a process for converting coke to acetylene; (3) advantages of making acetylene from coke; and (4) petrochemical products from coke.

213. JORGENSEN, ROBERT. Fans. Chem. Eng. Costs Quart., vol. 5, No. 4, October 1955, pp. 84-95.

An enumeration of systems requiring fans, followed by a discussion of types of fans, variations in construction, their performance, and their cost. Discussion of costs includes first cost of fans and equipment, operating costs and maintenance costs with cost curves to illustrate each category.

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214. **KARBOSKY, J. T., HENDERSON, M. L., AND KITZEN, M. R.** Economic Ethylene Production. Petrol. Proc., vol. 10, No. 8, August 1955, pp. 1211-1215.

Reports on using Selas Gradiation heater for producing ethylene. Economy of operation was a factor involved in test.

215. **KASTEN, P. R., AND CLAIBORNE, H. C.** Fuel Costs in Homogeneous U-235 Burners. Nucleonics, vol. 14, No. 11, November 1956, pp. 88-91.

Fuel costs are studied for spherical, single-region power reactors containing 90 percent enriched UO_2SO_4 in either D_2O or H_2O, and using 90-percent enriched feed. Data are presented in tabular form and mathematical formulation given. Conclusions of the cost study are summarized.

216. **KATZEN, RAPHAEL.** Help in Picking the Right Tray. Chem. Eng., vol. 62, No. 11, November 1955, pp. 209-212.

Presents cost and performance data to compare and evaluate five types of trays for distillation or absorption towers. Five types include bubble-cap trays, uniflux trays, flexitrays, turbogrid trays, and perforated trays.

217. **KAY, HERBERT.** What Hydrogen Treating Can Do. Petrol. Refiner, vol. 35, No. 9, September 1956, pp. 306-317.

Discusses development and growth of H_2 treating, describes various processes, and reviews economics of H_2 treating. Several comparisons are made, showing cost advantage of hydrogen treating over other methods; for example, in desulfurizing diesel fuel hydrogen treating was shown to be more advantageous than both SO_2 extraction and furfural extraction.

218. **KELLEY, HAROLD S., AND FILSON, ROGERS C.** Job Analyses Pay Dividends. World Oil, vol. 140, No. 2, February 1955, pp. 147-152, 156.

Time and method studies of lease producing operations result in improved efficiency of working force, lengthened life of lease equipment, and reduced downtime lost production. These time and method studies were applied to three broad categories of work, which are discussed separately with respect to:

1. Job functions.
2. Reorganization and design of the job and resulting savings.
3. Major tools and equipment needed for the redesigned work.

219. **KENNEDY, NORMAN F.** Starch: Raw Material Sources and Economics. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1405-1408.

Reviews economic factors influencing present contribution of each major raw-material source to the industrial supply of starch. Graphically presents comparative starch costs from 1940-54, including corn, tapioca, domestic potato, imported potato, Brazilian tapioca, and waxy maize.

220. **KERN, DONALD Q.** Opportunities in Plant Adaptation. Ind. Eng. Chem., vol. 46, No. 12, December 1954, pp. 2464-2466.

Discusses opportunities for adapting existing plants and equipment to new or other uses because present economic conditions have resulted in a lower return on investment. Discusses labor, equipment, and chemical price indexes.

221. KERN, DONALD Q., AND ASSOCIATES. Compare Exchanger Costs Quickly. Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 130-132.

A series of curves designed to permit quick selection of most economical heat-transfer surface.

222. KERSTEN, R. C., AND WARREN, T. W. That Octane-Improvement Headache. Oil Gas Jour., vol. 54, No. 65, July 30, 1956, pp. 176, 178, 180, 184, 185, 187.

A discussion and tabulation of economics of various octane improvement methods: TEL addition, catalytic reforming, catalytic reforming with increased severity, a combination of processes, polymerization, alkylation, and isomerization.

223. KIGUCHI, S. T., AND RIDGWAY, R. L. Check List for Superfractionator Design. Petrol. Refiner, vol. 35, No. 12, December 1956, pp. 179-184.

Discusses design, column costs, and instrumentation for superfractionators. Graphs show superfractionator column costs for various diameters and number of trays at both 24-inch tray spacing and 18-inch tray spacing. Instrumentation costs are $40,000-$50,000, based on board-mounted recorder-controllers. Installed instrument costs for composition analyzers will range between $1,000 to $10,000, plus $15 to $35 per square foot for the control house.

224. KING, ROBERT H. Planned Retirement for Tired Pump Units. Oil Gas Jour., vol. 54, No. 13, Aug. 1, 1955, pp. 119-120.

Discusses planned retirement of older engine-pump units in crude-oil gathering service to avoid costly maintenance and troublesome shutdowns. Presents a table giving operating costs for three 25-hp. engines, 15-25 years old, in good, fair, and poor conditions. The operating costs are compared with those of a replacement. Tabulation shows total annual savings of $210, $350, and $625, respectively, accomplished by replacement.

225. KINNEY, GENE T. Magnetic Recorders Pose Cost Problems. Oil Gas Jour., vol. 54, No. 50, Apr. 16, 1956, pp. 118-119.

While considered a major technical advance, the high cost of the magnetic recorder is creating a dilemna to contractors. Return on investment has not been big enough to pay for added expense. It is estimated that putting a magnetic recorder into a field truck costs about $25,000. If truck instruments are obsolete and have to be replaced, cost is nearer $50,000; playback unit adds another $25,000.

226. KIRKHAM, T. A. More Fresh Water Via Membranes. Chem. Eng., vol. 63, No. 10, October 1956, pp. 185-189.

Describes electric-membrane process for demineralizing water in terms of operation, maintenance, and cost, with accompanying graphs and tables.

227. **KIRTLEY, H. G., AND COLTER, W. G.** Proper Design for Painting. Chem. Eng., vol. 63, No. 2, February 1956, pp. 187-192.

By giving proper consideration at design stage to more economical painting maintenance, service life of a protective system on most plant equipment and structures can be increased. This does not necessarily mean that construction costs will be increased, although when such is the case, this must be justified by reduced painting maintenance in the future. Gives detailed discussion on factors to consider in reducing painting maintenance.

228. **KISER, G. E.** How to Plan and Control Capital Expenditures. Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 200-211.

Survey report on way 15 oil companies plan and control capital expenditures. Includes discussion of major aspects that enter into planning capital equipment expenditures and two factors in controlling capital expenditures.

229. **KLIMA, B. B., AND WARD, W. T.** N^{15} Cost When Produced by the Ammonia-Ammonium Carbonate Separation Process. Chem. Eng. Prog., vol. 52, No. 9, September 1956, pp. 380-387.

Development of a process for separating nitrogen isotopes by chemical exchange between ammonia and aqueous ammonium carbonate. Plant costs and product N^{15} cost were determined, using three different variations of process. A tabulated breakdown is given of investment cost, fixed cost, variable cost, and operating and product costs for three variations. Cost of producing 1 pound per day of N^{15} with an isotopic purity of 95 mole-percent is as follows: Case I: $4,014; case II: $4,573; and case III: $4,289.

230. **KOHLINS, W. D., AND ENGLANDER, H. P.** Cost Factors in Evaporation Design. Chem. Eng. Prog., vol. 52, No. 2, February 1956, pp. 45-F - 48-F.

Discussion of three general areas - physical design, flowsheet, and heat reclamation - recommended to process engineer for consideration in reducing costs in evaporator design and specification. Various examples are given and comparative costs shown to emphasize possibilities and effects of these three factors on evaporator costs.

231. **KRACKLANER, F. W.** Liquid Pressure Filters. Chem. Eng. Costs Quart., vol. 6, No. 3, July 1956, pp. 65-73.

Discusses batch-type pressure filters by two main categories: (1) Horizontal-element filter and (2) vertical-element filter. Cost information and recommendations for sizing and selecting filtration equipment are given.

232. **KRASE, NORMAN W.** Criteria for Discontinuing Operating Investments. Chem. Eng. Prog., vol. 52, No. 12, December 1956, pp. 495-499.

It is a well-known fact that some operating investments do not yield satisfactory financial results indefinitely, and some never attain a satisfactory level of earnings. Various aspects and problems connected with discontinuing an investment and factors to consider in reaching a decision on discontinuance are discussed.

233. KRIEGEL, PHILIP. Filter Presses. Chem. Eng. Costs Quart., vol. 5, No. 2, April 1955, pp. 36-54.

Discusses design, operation, and advantages of various types of filter presses and their component parts, including costs of filters of different capacities and of various materials of construction. Also gives example of determining filtration - one example being the filtration of chromium hydroxide and another clarifying of sweet cider.

234. KUNIN, ROBERT, AND McGARVEY, FRANK. Anionic Softening of Water With Strong-Base Anion Exchange Resins. Ind. Eng. Chem., vol. 47, No. 6, June 1955, pp. 1230-1235.

In a discussion of advantages of using quaternary anion exchangers for water softening, following tabulation is given to illustrate that costs are also comparable to those of other softening methods:

Water composition, p.p.m. (as $CaCO_3$)							
Hardness	Total concn.	F	HCO_3	S	Anion removed	Capacity, gal./cu. ft.	Amberlite resin
274	373	-	183	-	HCO_3	380	IRA-410
160	230	10	-	-	F	175	IRA-411
150	380	-	-	30	S	284	IRA-410

Reg. level cost[1]	
Lb. NaCl/ cu. ft.	Cents/1,000 gal.
4.0	10.7
1.0	5.7
4.5 NaCl .5 NaOH	21.0

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[1] Based upon cost of salt at 1 cent per pound and NaOH at 3 cents per pound. These values are estimates from actual installations.

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235. LAMBE, T. WILLIAM. Civil Engineering Need for Soil Chemicals. Ind. Eng. Chem., vol. 47, No. 11, November 1955, pp. 2234-2239.

Discusses civil engineering problems for which chemicals to alter soil properties are needed. Most promising soil additives are those effective at treatment levels of less than 1 percent of the soil dry weight and costing less than 10 cents per pound, although the maximum permissible price of soil additives varies from less than 1 cent per pound to over $500 per pound.

236. LANE, JAMES A. How to Design Reactor Shields for Lowest Cost. Nucleonics, vol. 13, No. 6, June 1955, pp. 56-58.

Analyzing shielding effectiveness and materials costs show starting points in low-cost reactor shield design. Separate calculations establish optimums for thermal and biological shields, after choosing attenuation required of each.

237. **LANE, JAMES A.** Reducing Nuclear Power Costs. Nucleonics, vol. 13, No. 1, January 1955, pp. 24-27.

Cost factors in obtaining power from homogeneous thermal breeder reactors are compared with similar factors for other reactors and coal plants.

238. _____. Where Reactor Development Stands Today. Nucleonics, vol. 14, No. 8, August 1956, pp. 30-37.

United States power-reactor programs are compared with non-United States programs, and cost figures are given for various United States programs. A comparison is made between cost of nuclear and conventional plants.

239. **LAPPLE, WALTER C., CLARK, WILLIAM E., AND DYBDAL, ERNEST C.** Drying Design and Costs. Chem. Eng., vol. 62, No. 11, November 1955, pp. 177-200.

Detailed article discussing selection of driers for specific purposes and including a complete estimation of costs, including installed costs, freight costs, labor and material costs, fixed charges and operating costs. One table includes a roundup of drier data: Costs, capacities, fuel, and power.

240. **LASZLO, TIBOR S.** How to Desulfurize Diesel Fuel. Petrol. Refiner, vol. 34, No. 1, January 1955, pp. 115-116.

Compares catalytic and solvent extraction processes for desulfurizing diesel fuel as to process principles, effectiveness, and costs.

241. **LAWRENCE, A. E.** Depreciation and Amortization. Chem. Eng. Prog., vol. 51, No. 5, May 1955, pp. 223-226.

Discusses depreciation and amortization with particular emphasis on their effect in the overall picture of cost estimating. Through explanations and illustrations, the various aspects of depreciation are presented, including a brief description of revised 1954 tax law concerning depreciation.

242. **LAWRENCE, J. C.** Costs - Process and Construction. Ind. Eng. Chem., vol. 46, No. 12, December 1954, pp. 65A-66A.

Discusses effect of depreciation allowances of new tax laws on mill cost-profit relationship and illustrates this effect by assuming a capital investment of $1,000,000 plant having a 10-year life and manufacturing 12,000,000 pounds per year of product. Also briefly compares differences in depreciation allowances under the old and new laws.

243. _____. Costs - Process and Construction. Ind. Eng. Chem., vol. 46, No. 7, August 1954, pp. 65A-66A, 68A.

Discusses trends in construction costs, including brief review of types of construction cost indexes made available from various sources.

244. _____. Costs - Process and Construction. Ind. Eng. Chem., vol. 46, No. 10, October 1954, pp. 77A-78A, 80A.

Discusses responsibility of and means used by engineers, builders, and contractors for reducing construction costs. Construction costs average primarily 40 percent for labor and 60 percent for materials. Overall costs of most process plants, because of higher proportion of materials and equipment, average 70-75 percent for materials and 25-30 percent for labor.

245. LEDFORD, R. F., AND HESLER, J. C. Treatment of Chromic Acid Wastes. Ind. Eng. Chem., vol. 47, No. 1, January 1955, pp. 83-86.

Economic evaluation of ion-exchange treatment led to selection of chromic acid recovery over conventional chemical treatment methods. Three tables present estimated cost information on following: (1) Removing chromium from rinse water by reduction and precipitation (total chemical and labor costs, $28,000 per day); (2) ion-exchange and evaporation costs for chromium plate reclaim resin recovery (total cost, $71.80 per day); (3) copper-strip chromic-acid recovery system (total cost, $41.08 per day).

246. LEGATSKI, T. W., AND ELDER, J. H. Using More Natural Gasoline in Motor Fuels. Oil Gas Jour., vol. 53, No. 27, Nov. 8, 1954, p. 185.

Tabulates additional daily income in thousand dollars per day per 100,000 barrels of gasoline capacity from blending butane under various assumed conditions of current distillation and vapor-pressure characteristics. The proper blending of available butane may also result in savings amounting to $100,000,000.

247. LENNON, J. J. The Nettco Flomix Continuous Mixer. Chem. Eng. Costs Quart., vol. 5, No. 3, July 1955, pp. 65-68.

Detailed description of Nettco Flomix (a patented mixer for continuous agitation of solutions as they pass through a pipeline) and cost of these mixers, based on pipe size, in either cast-iron or Type 304 stainless steel.

248. LEONARD, JACKSON D. Accounting is an Effective Maintenance Tool. Petrol. Refiner, vol. 35, No. 1, January 1956, pp. 229-231.

An argument is presented for using accounting procedures for maintenance cost control similar to production cost control methods.

249. LEVIN, EZRA, AND FINN, R. K. A Process for Dehydrating and Defatting Tissues at Low Temperature. Chem. Eng. Prog., vol. 51, No. 5, May 1955, pp. 223-226.

Describes azeotropic dehydration process and discusses economics of process and its potentialities.

250. LEWIS, E. H. Hydrofining Catalytic Cracking Feed Stocks. Oil Gas Jour., vol. 54, No. 11, July 18, 1955, pp. 95-96.

Discusses desulfurizing virgin and cracked gas oils by Hydrofining, including operating conditions, properties of feed and products, yields, and economics. For a refinery using relatively low concentrations of tetraethyllead, the greater yield and higher octane number of the naphtha have been evaluated for a particular refinery case to be worth 22 to 23 cents per barrel of feed to catalytic cracking. These values are for once-through cracking. Because quality of the cycle stock is greatly improved, corresponding values for recycle cracking are at a level of 41 to 43 cents per barrel.

251. LINDER, E. G., RAPPAPORT, P., AND LOFERSKI, J. J. Atomic Batteries Await Low-Cost Materials. Chem. Eng. Prog., vol. 52, No. 2, February 1956, pp. 60-61.

Four principal problems are yet to be solved to achieve development of a nuclear battery which translates energy into electric power. If a radioactive material of low cost, low quantum energy and a long half-life could be found, it appears that all other obstacles could be solved.

252. LINEHAM, R. W. Propane Market - What You Should Know. Petrol. Refiner, vol. 35, No. 4, April 1956, pp. 163-165.

Discusses transportation costs, supply, price trends, and storage.

253. LIVINGSTON, R. S., AND BOCH, A. L. ORNL's Design for a Power Reactor Package. Nucleonics, vol. 13, No. 5, May 1955, pp. 24-27, 46.

Description of Oak Ridge National Laboratory's Package Power Reactor covering "the core, pressure vessel, cooling and control systems, shielding, costs, and calculations for criticality and control."

254. LOGAN, L. J. Oil Investment Soon to Reach $47 Billion. World Oil, vol. 139, No. 2, August 1954, pp. 84-85.

By the end of 1954, the petroleum industry will have a gross investment in the United States of $47 billion, including $4 billion of capital expenditures being made in 1954. In terms of investment or assets, it now ranks as the third largest industry in the United States.

255. LOOFBOUROW, R. L. After 5 Years Excavated Underground Storage Applicable to All Types of Petroleum Products. Oil Gas Jour., vol. 53, No. 31, Dec. 6, 1954, pp. 115-118.

Discusses in some detail 4 principal types of underground storage and includes a capital cost comparison for storing oil, propane, and natural gas by these 4 methods, as well as by several types of surface storage.

256. LOOSLI, A. R. Management of Inventories and Costs. Ind. Eng. Chem., vol. 48, No. 11, November 1956, pp. 35A-36A.

Discusses inventory control and cost reduction as functions of plant management and criteria to be considered in solving problems of each.

257. LUDWIG, E. E. How to Specify - High-Pressure Vessels. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 108-112.

Offers suggestions and assistance for preparing specifications for high-pressure vessels.

258. LUDWIG, E. E., AND SHORKEY, A. F. Guide for Picking the Right Bid. Chem. Eng., vol. 62, No. 1, January 1955, pp. 181-184.

Compares bids on an evaporation system for caustic soda to stress role of bids in overall cost picture. Tables giving a check list to follow, case-history data, and other known factors are presented, as well as a table comparing bids in hypothetical example chosen by authors.

259. LUNDEEN, R. W., AND CLARK, W. G. Cost of Installing Centrifugal Pumps. Chem. Eng., vol. 62, No. 8, August 1955, pp. 189-190.

Series of graphs and accompanying data that can result in a close estimate of cost involved in installing a single centrifugal pump. By adding installation cost to delivered cost of pump and motor, total installed cost is known.

260. _____. How Much for Rubber-Lined Vessels? Chem. Eng., vol. 62, No. 3, March 1955, pp. 191-193.

Series of cost curves to assist in preparing job estimates on projects requiring rubber-lined tanks and pressure vessels. Data cover a wide range of sizes and shapes.

261. LYNN, C. V. Oil Storage Tanks. Oil Gas Jour., vol. 53, No. 45, Mar. 14, 1955, pp. 104-106; vol. 53, No. 49, Apr. 11, 1955, pp. 111-114.

Discusses rising costs of oil-storage tanks and how economies may be affected by proper selection, sound construction, efficient upkeep, and timely retirement. Includes graphs showing costs of new oil-storage tanks vs. capacity.

Concluding article in a discussion of factors to consider in selecting oil-storage tanks. Deals with fittings and attachments, painting and other maintenance, inspection, and retirement. Some costs cited in discussion are as follows: Painting - costs approximately $1.00-$2.50 per 100 square feet of tank surface per year to paint a new tank and keep it painted over a reasonable life span. General average is about $1.51 per square foot. Labor in connection with painting is principal element of expense. Sandblasting, for example, costs $6 to $8 per 100 square feet.

262. _____. Oil-Storage Tanks. Petrol. Eng., vol. 27, No. 10, September 1955, pp. D-13 - D-21.

Discusses selection, maintenance, and retirement of oil-storage tanks by Sinclair Refining Company. Presents graphs showing cost per barrel for various types of tanks and a computation of annual unit tank painting costs and effect of increased life with painting cost are given.

263. _____. Protect Your Tank Investments. Petrol. Proc., vol. 10, No. 3, March 1955, pp. 361-365.

Discusses tank-cost control by careful selection, erection, maintenance, and well-timed retirement. Includes estimated costs of tanks by type, and economical retirement age for a tank. Gives method for figuring unit tank painting costs.

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264. McAFEE, JERRY, MONTGOMERY, C. W., SUMMERS, C. R., JR., HIRSCH, J. H., AND HORNE, W. A. Upgrading Crudes and Residues. Oil Gas Jour., vol. 54, No. 2, May 16, 1955, pp. 196-200, 202, 204.

Complete description, with accompanying flow diagram and tables of results, of Gulf HDS process. It is estimated that a 20,000-barrel-per-calendar-day, fixed-bed unit for whole West Texas crude oil would require an investment of approximately $500 per barrel of daily capacity, a direct operating cost of 25 cents per barrel, and a total operating cost (including 10 percent depreciation and all fixed charges) of 50 cents per barrel. The same capacity plant to process a 71- to 29-percent blend of Kuwait vacuum-tower bottoms and light catalytic recycle oil would require an investment of $800 per barrel and have a direct operating cost of 75 cents per barrel and a total operating cost of $1.10 per barrel. These investment and operating costs include complete facilities for manufacturing H_2. If byproduct H_2 were available, as it is in many instances today, these costs would be reduced considerably.

265. McCABE, LOUIS C. Atmospheric Pollution. Ind. Eng. Chem., vol. 47, No. 12, December 1955, pp. 83A-84A.

A new catalytic muffler has been developed to clean exhaust gases from in-plant materials handling equipment. Erected cost of a typical commercial catalytic boiler unit is $450,000, and catalytic section of such a boiler costs $129,600, an annual cost of $66,750. Net saving per year by such a unit is $133,260.

266. McCORMICK, E. G., AND WETZEL, O. K., JR. Water Supply From Sewage Effluent. Petrol. Refiner, vol. 33, No. 11, November 1954, pp. 165-167.

Gives story of 10 years of utilization of effluent from a municipal sewage-treatment plant. Brief treating costs included.

267. McGHEE, ED. Corrosion Costs Soar. Oil Gas Jour., vol. 54, No. 25, Oct. 24, 1955, p. 68.

Gulf Coast operators are spending $2.5 million annually for painting alone to fight corrosion of offshore platforms. To reduce these costs, improved platform design must be developed which will reduce surface area in all parts of structure, eliminate hard-to-coat areas, and protect both coatings and platform from mechanical damage.[10]

268. _____. Something New in a Submersible Barge. Oil Gas Jour., vol. 54, No. 86, December 1956, pp. 58-61.

Describes design and specifications of a new submersible barge, rig 46, constructed for offshore drilling. Complete cost of construction, fitting out with rig, engineering, and overhead resulted in an investment of $3,300,000, that compares favorably with cost of other devices designed for drilling in 70 feet of water.

269. _____. Vapor Recovery Has Quick Payout. Oil Gas Jour., vol. 54, No. 8, June 27, 1955, p. 98.

Briefly discusses the vapor-recovery systems employed in three of Superior Oil Co. tank batteries. First unit installed cost $3,266 and operator's investment was fully recovered in 1 year. Next two units cost $2,886 each.

270. McKINLEY, DEE C. P. D. Meters Get the Job Done. Oil Gas Jour., vol. 54, No. 74, Oct. 1, 1956, pp. 87-90, 92.

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[10] Stauffer, Daniel B., Reduced Upkeep Cost on Drilling Platforms Begins With Good Design: Oil Gas Jour., vol. 54, No. 31, Dec. 5, 1955, pp. 103-105.

Discusses selection, installation, maintenance and economics of using positive-displacement meters as a measurement facility. Installation of such meters for measuring a 100,000-barrel-per-day capacity cost approximately $40,000 to $50,000, compared with a probable investment of $215,000 for constructing three 55,000-barrel tanks for the same purpose.

271. McLEAN, JOHN G. The Oil Industry is More Integrated Than You Might Think - Here's Why. Oil Gas Jour., vol. 53, No. 28, Nov. 15, 1954, pp. 245, 246, 248-250, 252, 254.

Summarizes a research study by Harvard Business School on importance of vertically integrated companies in the petroleum industry. Shows advantages of this integration and lists opportunities offered for cost reduction.

272. MAGUIRE, JOHN F. Atmospheric Drum Driers and Flakers. Chem. Eng. Costs Quart., vol. 6, No. 2, April 1956, pp. 37-41.

Various components of an atmospheric drum drier and of drum flakers are described and curves are presented from which cost of such equipment can be estimated.

273. MANOWITZ, B., AND RICHMAN, D. M. Economic Future of Fission Products for Radiation Power. Nucleonics, vol. 14, No. 6, June 1956, pp. 98-102.

Discusses reprocessing of spent reactor-fuel elements as a business. Discusses growth, radiation-power costs, market analysis, type of plant, investment, and waste disposal.

274. MAYLAND, B. J., COMLEY, E. M., AND REYNOLDS, J. C. Partial Oxidation With Air. Oil Gas Jour., vol. 53, No. 25, Oct. 25, 1954, pp. 94-97.

A comparison of three modifications and the conventional process for manufacturing ammonia gas from natural gas. Presents process steps, a summary of flow schemes, flow diagrams, and an economic evaluation for each. This latter includes investment figures for 4 cases based on 120-ton-per-day anhydrous ammonia plant; a summary of utilities requirements on same basis; a plot of comparative costs of ammonia processes vs. cost of natural gas; a cost schedule for natural gas, cooling water, electric power, etc; and cost per ton of ammonia for 4 cases. This economic comparison reveals that air partial oxidation under pressure is economically advantageous.

275. MEADE, L. P., AND JENNINGS, G. P. Tri-Fuel Engines in Pipeline Service. Petrol. Eng., vol. 26, No. 7, July 1954, pp. D-11 - D-14.

Discusses operating and economic advantages of a four-cycle diesel engine capable of burning diesel oil, natural gas with pilot oil, or, with minor conversions, capable of operating on natural gas with spark ignition.

276. MEKLER, L. A. Mechanical Design of Processed Tubular Heaters, Part II. Petrol. Eng., vol. 28, No. 3, March 1956, pp. C-15 - C-20.

Discusses various types of tubular heaters and gives comparative cost figures for each type.

277. **MEKLER, VALENTINE, SCHUTTE, A. H., AND WHIPPLE, T. T.** Continuous Contact-Coking Costs Less Than Older Processes. Petrol. Eng., Ref. Ann., vol. 26, No. 8, July 15, 1954, pp. C-10 - C-13.

Describes a 1,000-barrel-per-day Lummus Company, fluid contact coker and related operational data, including an economic comparison between contact and delayed coking processes.

278. **MENARD, H., AND BLOSSOM, E. D.** Advantages of Latent Cooling of Compressors. Petrol. Eng., vol. 27, No. 9, August 1955, pp. C-12 - C-15.

Discusses water cooling of engine jackets by conventional cooling, hot-water cooling, and latent cooling and gives advantages of each. By comparing operating factors and cost factors, latent cooling is shown to have advantages over other methods.

279. **MERCHANT, M. EUGENE, ERNST, HANS, AND KRABACHER, E. J.** Tool-Wear Tests Speeded. Nucleonics, vol. 14, No. 5, May 1956, pp. 55-57.

Describes radioactive tracers method of measuring tool wear. Contains brief discussion of economics of method and estimates Nation could save $1 billion annually.

280. **MEYRE, RONALD E.** New Avenue for Capital-Oxidation of LPG? Petrol. Refiner, vol. 35, No. 12, December 1956, pp. 172-178.

Because petrochemical industry seems to be suffering from high earnings and shrinking profits, some solution must be found to problem. One possibility is oxidation of LPG, a process that has already been tried by Cities Service and Celanese Corp.

281. **MINET, R. G., AND MIRKUS, J. D.** Cost-Saving Techniques for Instrumenting a Fluidized-Bed Pilot Plant. Chem. Eng. Prog., vol. 52, No. 12, December 1956, pp. 531-534.

Discusses use of various instruments and methods of installation that will result in considerable savings in instrumentation cost for a pilot plant. A tabulated comparison is made between typical pilot-plant instrumentation and commercial practice and resulting percentage of savings on each.

282. **MINET, R. G., SMITH, H. B., JR., AND TRILLING, C. A.** Economics of Coal Carbonization by the Low-Temperature Process. Chem. Eng. Prog., vol. 50, No. 7, July 1954, pp. 342-346.

Describes a low-temperature carbonization process developed by United Engineers and Constructors, Inc. A summary of economic factors is tabulated as follows:

Initial investment	$11,500,000
Gross annual sales	$11,061,000
Operating cost	$ 7,493,000
Annual profit	$ 3,568,000
Percent return on initial investment	31
Annual profit after Federal income taxes of 25% ..	$ 1,713,000
Percent return on initial investment after taxes..	15
Break-even price of char, cents/million B.t.u. ...	18.5

Basis: Plant on stream 330 days per year charging 8,520 tons per day of Ohio high-volatile bituminous coal at $0.258 per million B.t.u. or $6.07 per ton.

283. MIXER, RICHARD A., AND OECHSLE, S. JOHN, JR. Materials of Construction - Part I. Protective Lining Systems. Chem. Eng., vol. 63, No. 11, November 1956, pp. 176-196.

Discusses principal needs for linings, selection of linings (with check sheet included), factors to consider for lining specifications, and comparative costs. Accompanying bar charts present comparative costs for 1,000- to 100,000-gallon tanks, unlined and lined with different materials. Comparative costs are also given for 300,000- and 1,000,000-gallon lined tanks and for pipe and ducts. The cost cited are representative of the present-day costs (probably within 10 percent).

284. MOORE, B. L. High-Voltage Distribution Systems Designed for Economy. World Oil, vol. 139, No. 5, October 1954, pp. 203-206, 208, 210, 213.

Discusses economic advantages attained in using higher voltage distribution systems. Comparative cost analyses are given for 440-, 762-, and 880-volt systems equipped with various size motors.

285. MOORE, O. H. How T.G.T. Cuts Operating Costs. Oil Gas Jour., vol. 54, No. 53, May 7, 1956, pp. 119-122.

Describes various improved pipeline compressor techniques developed by Tennessee Gas Transmission Co. that have resulted in reduced operating costs while adding to its system capacity.

286. MOORMAN, J. W. What Is the Effect of Feed Preheat in Catalytic Cracking? Oil Gas Jour., vol. 53, No. 36, Jan. 10, 1955, pp. 68-73.

Discusses feed-preheat requirement as one of the most important operating variables in catalytic cracking. Savings realized from use of a fixed fresh-feed rate, increasing the feed-preheat temperature from 400° to 600° F. at constant conversion, are claimed to be in the range of $350 to $650 per day.

287. MORBECK, R. C. Hydrofining of Middle Distillates. Oil Gas Jour., vol. 53, No. 35, Jan. 3, 1955, pp. 94, 96, 98.

Discusses use of hydrofining process for finishing (improving) quality of kerosines, heating oils, and diesel fuels; and includes tables of properties for each type. Investment cost for a 10,000-barrel-per-day unit might be in the range of $90-$110 per barrel with average industry standards and contractors' fees. Operating costs will be in the range of 10-15 cents per barrel.

288. MOTE, MORRIS. Cathodic Protection. Mines Mag. (Colo.), vol. 44, No. 12, December 1954, pp. 35-38, 42.

Discusses thermodynamics of corrosion, anodic coatings, cathodic protection by impressed voltage, estimated cost of protection, and determining protection requirements.

289. **MULCAHY, P. H.** Reitz Thermascrews. Chem. Eng. Costs Quart., vol. 6, No. 4, October 1956, pp. 84-88.

Discusses advantages of a double-wall screw conveyor, known as Reitz Thermascrew, as a means of enclosed direct heating and cooling of solids and semiliquid substances.

Two basic designs are available, depending upon process requirement: (1) Conveyor type, and (2) agitated-vessel type. Cost curves are presented for both conveyor units and twin-screw agitated-vessel units of either carbon-steel construction or stainless steel Type 304.

290. **MUNRO, J. D.** Here's How to Obtain Longer Service From Heat Exchangers. Oil Gas Jour., vol. 53, No. 12, July 26, 1954, pp. 226, 228, 231, 232, 234, 236, 238-240, 242-244, 246,249, 250.

Summary of results of specialized studies and operating experience by Standard Oil Co. (N. J.) on corrosion problems with heat exchangers in cooling-water service. Presents comparative costs (as of March 1954) of tubes of various materials and comparative costs of linings for coolers and condensers. Also gives materials used for coolers and condensers under current design practice and recommended future practice.

291. **MURRAY, F. J. JR.** Spray Drying Equipment. Chem. Eng. Costs Quart., vol. 6, No. 4, October 1956, pp. 89-96.

Article is in three main parts: (1) Sizing of equipment, (2) estimation of initial cost, and (3) operating costs. In determining size of a spray drier, there are three indispensable considerations: Solids concentration of the liquid, operating temperatures, and retention time. In estimating initial cost, the following factors are important: Size, type of construction, type of basic equipment, and extent of engineering service supplied by the manufacturer.

Operating costs are expressed in terms of cost of water evaporated. Curves showing both initial cost and operating costs are given.

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292. **NELSON, W. L.** Cost-Imating. Oil Gas Jour.

This is a series of cost-estimating articles appearing in the Oil and Gas Journal in January, April, July, and October issues of each year (usually the first issue of the month). They show current cost indexes for equipment, plants, and associated items.

Ref. No.	Title	Vol.	No.	Date	Page
292-1	Refinery Construction Costs Not Changing Significantly	53	9	July 5, 1954	148
292-2	Increased Wages Threaten to Increase Construction Costs	53	22	Oct. 4, 1954	167
292-3	How to Use Itemized Cost Indexes	53	36	Jan. 10, 1955	107
292-4	Labor at Last Profits	53	49	Apr. 11, 1955	131-132
292-5	Prices of Materials Rising Again	54	9	July 4, 1955	121-122

Ref. No.	Title	Vol.	No.	Date	Page
292-6	Construction Costs Continue to Rise	54	22	Oct. 3, 1955	145-146
292-7	Quick Costs for Heat Exchangers	54	29	Nov. 21, 1955	257
292-8	Storage Tanks are Major Refining Costs	54	31	Dec. 5, 1955	137
292-9	Nearly All Cost Indexes Have Increased	54	35	Jan. 2, 1956	119
292-10	Refinery Construction Costs Continually Rise	54	36	Jan. 9, 1956	121
292-11	Inflation of Refinery Construction Costs	54	35	Jan. 2, 1956	119
292-12	Prices of Pipe Stills	54	55	May. 21, 1956	245
292-13	Can Inflation in Construction Costs Be Halted?	54	61	July. 2, 1956	119
292-14	Wages Have Outstripped Materials Since 1952	54	74	Oct. 1, 1956	111
292-15	Cost Computer for Vessels	54	38	Jan. 23, 1956	97
292-16	How to Estimate Fractionator Costs	54	42	Feb. 20, 1956	155-156
292-17	Cost of Lumber and Lumber Construction	54	44	Mar. 5, 1956	123
292-18	Cost of Brick, Cement, and Clay Products	54	47	Mar. 26, 1956	151
292-19	Refinery Depreciation Rates	54	51	Apr. 23, 1956	141
292-20	Costs of Furnace Details	54	57	June 4, 1956	113
292-21	Cost of Steam-Generation Equipment	54	63	July 16, 1956	122

293. NELSON, W. L. Nelson Refinery Construction Index. Oil Gas Jour.

A series of articles appearing monthly in Oil and Gas Journal (usually the first issue of each month). Included are cost indexes for pumps, compressors, etc., electrical machinery; internal combustion engines; instruments; heat exchangers; miscellaneous equipment average; materials component; labor component, and refinery construction.

Ref. No.	Vol.	No.	Date	Page
293-1	53	9	July 5, 1954	159
293-2	53	13	Aug. 2, 1954	115
293-3	53	18	Sept. 6, 1954	130
293-4	53	22	Oct. 4, 1954	179
293-5	53	26	Nov. 1, 1954	120
293-6	53	32	Dec. 13, 1954	153
293-7	53	36	Jan. 10, 1955	80
293-8	53	41	Feb. 14, 1955	99
293-9	53	45	Mar. 14, 1955	117
293-10	53	49	Apr. 11, 1955	127
293-11	53	52	May 2, 1955	101
293-12	54	5	June 6, 1955	137
293-13	54	9	July 4, 1955	105
293-14	54	13	Aug. 1, 1955	104
293-15	54	18	Spet. 5, 1955	125
293-16	54	22	Oct. 3, 1955	122
293-17	54	27	Nov. 7, 1955	92
293-18	54	31	Dec. 5, 1955	135
293-19	54	35	Feb. 2, 1956	111
293-20	54	44	Mar. 5, 1956	100
293-21	54	48	Apr. 2, 1956	103
293-22	54	53	May 7, 1956	134
293-23	54	57	June 4, 1956	99

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293-24	54	61	July 2, 1956	98
293-25	54	66	Aug. 6, 1956	104
293-26	54	70	Sept. 3, 1956	119
293-27	54	74	Oct. 1, 1956	110
293-28	54	79	Nov. 5, 1956	90
293-29	54	83	Dec. 3, 1956	101

294. NELSON, W. L. Questions on Technology. Oil Gas Jour.

A series of technological questions and answers are discussed in the Oil and Gas Journal by W. L. Nelson.

Ref. No.	Title	Vol.	No.	Date	Page
294-1	Present Cost of O_2 and O_2 Plants	53	12	July 26, 1954	273
294-2	Cost of Refining High-Sulfur Crudes	53	15	Aug. 16, 1954	150
294-3	How Operating Costs Have Changed	53	18	Sept. 6, 1954	127
294-4	Cost of Oil-Handling Vs. Coal-Handling Systems	53	19	Sept.13, 1954	138
294-5	Penalty for High-Sulfur Crude Oils	53	29	Nov. 22, 1954	93-95
294-6	What Are Average Costs of Refining?	53	31	Dec. 6, 1954	139
294-7	Value of World Competitive Crude-Oils	53	35	Jan. 3, 1955	116-117
294-8	How Much Does Refrigeration Cost?	53	43	Feb. 28, 1955	134
294-9	Value of Octane Number	53	51	Apr. 25, 1955	135
294-10	Have Electrical Equipment Prices Risen?	53	52	May 2, 1955	109
294-11	Prices of Paint and Paint Materials	54	2	May 16, 1955	196-200 202, 204
294-12	Petroleum Coke in Steel Manufacture	54	4	May 30, 1955	104
294-13	Cost Index for Hand Tools Explained	54	8	June 27, 1955	107
294-14	Cost of Pumping With Different Types of Engines and Motors	54	11	July 18, 1955	112-113
294-15	Prices of Industrial Steel Materials	54	12	July 25, 1955	251
294-16	Separate Penalties for High Sulfur and Sourness	54	13	Aug. 1, 1955	119-120
294-17	Effect of Steel-Price Hike on Costs	54	15	Aug. 15, 1955	183
294-18	Cost of Upgrading Octane Number	54	18	Sept. 5, 1955	129-130
294-19	Prices of Pipe-Still or Boiler Tubes	54	18	Sept. 5, 1955	130
294-20	Cost-Imating	54	27	Nov. 7, 1955	127
294-21	Cost of HCl Plants	54	49	Apr. 9, 1956	131
294-22	Effect of Refinery Capacity on Operating Costs	54	66	Aug. 6, 1956	109-110
294-23	Cost of Dewaxing Plants	54	78	Oct. 29, 1956	118
294-24	Effect of Gravity on Refinery Operating Costs	54	82	Nov. 26, 1956	99-100
294-25	Effect of Reduced Capacity on Refinery Operating Costs	54	85	Dec. 17, 1956	146-147
294-26	Cost of Refining High-Sulfur Crudes	54	87	Dec. 31, 1956	207

295. _____. Refinery Building Costs Continue Rise Pattern. Oil Gas Jour., vol. 53, No. 39, Jan. 31, 1955, pp. 261-262.

Presents chart showing the rise in the building cost index by elements of labor, materials, heat exchangers, pumps and compressors, miscellaneous equipment, electrical machinery, instruments, internal-combustion engines, and the over-all index. A second chart gives the index for these same elements for each month of 1954.

296. NELSON, W. L. Summary for Quick Cost Estimates. Oil Gas Jour., vol. 54, No. 35, Jan. 2, 1956, p. 120.

Presents a list of various items usually comprising a cost estimate and gives percentages for each as related to Plant Cost Total. Further explains the application of this summary in preparing cost estimates.

297. _____. What Aluminum Alloys Offer Refiners. Oil Gas Jour., vol. 53, No. 9, July 5, 1954, p. 151.

Discusses properties, costs, and refinery applications of aluminum alloys.

298. NEWTON, E. C., AND CONETTA, M. A. How Maintenance Costs Can Be Controlled. Petrol. Refiner, vol. 35, No. 3, March 1956, pp. 221-224.

Describes Atlantic Refining Company's 5-year improvement program.

299. NEWTON, R. D., AND WEIL, C. W. Economic Evaluation of Plant Expansion. Ind. Eng. Chem., vol. 46, No. 12, December 1954, pp. 2488-2491..

Before considering any capital investment in plant expansion, its economic future should be carefully evaluated. An appraisal of the following factors - variation of sales price, manufacturing cost, profit, and capital investment - presented graphically will usually indicate the advisability or soundness of such a venture.

300. NODDINGS, C. R., HEATH, S. B., AND COREY, J. W. Conservation of Butylenes in Butadiene Manufacture. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1373-1376.

Discusses history, production and performance, operating problems, testing methods, and economic factors involved in development and use of a calcium-nickel phosphate catalyst for dehydrogenation of n-butenes to 1, 3-butadiene. Two tabulations present the possible economic debits and credits to Type B Catalyst and calculation of cost of butadiene production.

301. NOLL, H. D., SCHALL, J. W., CRAIG, R. G., AND STEVENSON, D. H. 100 Clear Octane...by the New Houdry "Iso-Phis' Process. Oil Gas Jour., vol. 53, No. 47, Mar. 28, 1955, pp. 102-105.

To arrive at economic comparisons, four methods are considered in the reforming of 6,000 barrels per calendar day of a typical 200°-394° F. virgin naphtha containing 46 percent paraffins to 100 F-1 clear octane.

Based on the economic summary, each process is revealed in the order of its attractiveness for consideration in the particular application desired.

302. NORDELL, ESKEL. Water...How It's Treated. Chem. Eng., vol. 62, No. 10, October 1955, pp. 175-184.

Discusses main types of water-conditioning processes using illustrative sketches, diagrams, photos, tables. Also discusses costs of various water-treatment methods.

303. NUCLEONICS. Goal: Economic Power in 10 years. Vol. 12, No. 7, July 1954, pp. 48-51.

Gives nine approaches to goal of economic power from atomic energy. Some cost figures are given.

304. _____. Nuclear Power-Capital Outlay. Vol. 13, No. 9, September 1955, pp. 36-37.

Discusses cost of both conventional and nuclear power plants.

305. _____. Progress on Materials - Key to Gas-Cycle Reactor Potential. Vol. 14, No. 3, March 1956, pp. 42-44.

Compares characteristics of four single-loop gas-cycle reactors, with some cost figures. Gives general description of gas-cycle type reactor.

306. _____. U. S. Manufacturer's Offer These Reactors for Export. Vol. 14, No. 11, November 1956, pp. 70-75.

Name of company, type of reactor, design and performance, characteristics, and price range are presented in tabular form.

307. _____. Where Does Food and Drug Processing Stand? Vol. 13, No. 1, January 1955, pp. 36-39.

Cost figures are given for research programs in progress by food and drug industries.

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308. OIL AND GAS JOURNAL. Ammonia Boom Spurs Plant Construction. Vol. 53, No. 39, Jan. 31, 1955, pp. 174-175.

Lists 6 natural-gasoline plants and 36 petrochemical plants under construction, including company, location, and in some cases, the capacities and the costs.

309. _____. Catalysis in Petroleum Refining. Vol. 53, No. 46, Mar. 21, 1955, pp. 160-161.

Among a discussion of 24 catalytic processes are described the Phillips' Petroleum hydrofluor and alkylation processes and Stanolind's Ultraforming process. Former includes a summary of investment operating expense, 98-percent stream factor. Total direct operating expense is shown to be $0.51 per barrel alkylation.

Brief description of Ultraforming process includes operating conditions, yields, catalyst, charge, and products properties. Replacement cost of catalyst is listed at $4.00 per pound; operations catalyst cost is listed at less than 4 cents per pound.

310. _____. Centrifugal Compressors Cut Operating Costs. Vol. 54, No. 79, Nov. 5, 1956, pp. 137-138, 140.

Cost factors are compared to determine if a centrifugal-compressor station is more advantageous than a reciprocating-compressor installation. Based on conditions requiring a bushing and contact seal combination to reduce oil consumption, this cost comparison reveals that the operating cost of the centrifugal station is $50 less per horsepower than the centrifugal and cost of construction per brake horsepower was $235 and $198, respectively.

311. OIL AND GAS JOURNAL. Cost Survey Starts. Vol. 53, No. 41, Feb. 14, 1955, p. 78.

In an attempt to find out how much it costs to produce 1 barrel of crude oil, in addition to other data, a joint survey is being made by the A.P.I., Independent Petroleum Association of America, and Mid-Continent Oil and Gas Association. Questionnaires have been sent to about 2,500 oil producers, both large and small, in various parts of the country.

312. _____. D-J Prices Posted. Vol. 54, No. 42, Feb. 20, 1956, p. 96.

For first time by major buyers field prices have been posted for crude oil in the Denver-Julesburg Basin. Posted prices start at $2.83 per barrel for crude of 40° gravity and above and scale down to $2.41 per barrel for 20° and lower gravity. Discusses the significance of these posted prices with regard to marketing and also the effect on connected and unconnected producers.

313. _____. Ethylene - 3. Polyethylene Push. Vol. 53, No. 18, Sept. 6, 1954, pp. 99-102.

Discusses development and contemplated future expansion of polyethylene production together with description of processes employed, present production capacity (tabulated breakdown of companies, capacities, and investments), chemistry, and applications of polyethylene.

314. _____. Heavy Resid Fuels. Vol. 53, No. 32, Dec. 13, 1954, p. 91.

Briefly discusses two low-cost methods for treating heavy residual oil fuels to reduce deposition and corrosion. One method, consisting of desalting and putting in additives, is reported to cost approximately 14 cents per barrel for fuel treatment including the heat. Second method tried in Switzerland, utilizes kaolin and metallic additives blended to fuel and is reported to cost 12 cents per barrel. It is believed that further developments may reduce cost of treating residual fuels 3-5 cents per gallon.

315. _____. High Octanes at Low Cost. Vol. 54, No. 64, July 23, 1956, pp. 96-99.

Discusses and, with curves and tables, illustrates increased yields of gasoline of higher octane number by using Penex process in conjunction with Platforming process. Operating costs and profitability resulting from the addition of Penex are also tabulated. Additional capital investment required for Arabian straight-run is $1,700,000 with a payout on investment of 1.9 years. For Wyoming straight-run additional capital investment is $1,850,000 and payout time is 2.1 years.

316. _____. How to Design In-Tank Jet-Mixing Systems. Vol. 53, No. 18, Sept. 6, 1954, p. 125; vol. 53, No. 21, Sept. 27, 1954, pp. 111-112.

Discusses present tank-mixing techniques of recirculation and propeller mixing and compares them with in-tank jet mixing. A brief description is given of two most commonly used methods: (1) Recirculation system, and (2) in-tank propeller mixer system. Also includes relative cost tables.

Three different situations are assumed as bases to compare most economical mixing system in each instance. For each case a summary is made giving required installation for each method, approximate annual power costs, and piping and pump time per blend.

317. OIL AND GAS JOURNAL. Latest Idea in Product Storage... Esso Finishes Quarry Facility. Vol. 53, No. 18, Sept. 6, 1954, pp. 56-57.

Describes million-barrel converted quarry oil storage pit just completed at Wind Gap, Pa., by Esso Standard Oil Co. at a cost of $500,000 for first pit. Modification of this first quarry cost Esso about 50 cents per barrel of storage capacity as compared with $2 per barrel for conventional steel storage tanks. Even an additional cost of 7-10 cents per barrel for moving products to and from storage makes the project still attractive.

318. _____. Lower Coating Costs. Vol. 53, No. 28, Nov. 15, 1954, pp. 156-157.

Abstract of a paper by S. G. Kershner on pipeline coating presented at API meeting in Chicago. Coating cost is given as 6 to 7 percent of total cost of laying a line. Coating an 8-inch line costs $1,500 per mile and a 24-inch line costs $4,000 per mile. Cathodic protection adds 5 to 6 percent to coating cost figures. Power costs for operation will average, overall, approximately $3.50 per mile per year.

319. _____. New Chart for Calculating Power Costs. Vol. 54, No. 75, Oct. 8, 1956, p. 273.

Presents a chart developed by Corrosion Services, Inc., which is designed to speed calculations of annual costs using different combinations of anodes and spacings in a cathodic protection installation.

320. _____. New Process Expands High-Octane Pool. Vol. 54, No. 52, April 30, 1956, pp. 86-87.

Describes the Isomerate Process developed by Pure Oil Co. and its significance as a technique for upgrading light naphthas. Unit costs have not been released but is is believed that a 5,000 barrel-per-day unit can be built for about $500 or less per barrel of daily capacity.

321. _____. Oil Men Investing in Future. Vol. 54, No. 52, Apr. 30, 1956, pp.90-91.

Second economic survey conducted by the API, the Independent Petroleum Association of America, and the Mid-Continent Oil and Gas Association reveals that tremendous amounts of capital are being "plowed back" for expansion. Costs were broken down as follows:

Production spending: 43 cents per barrel in 1944, 70 cents in 1948, and 95 cents in 1953

Exploration outlay: 45 cents per barrel in 1944, 64 cents in 1948, and 95 cents in 1953

Development spending: 59 cents per barrel in 1944, 87 cents in 1948, and $1.19 in 1953

Oil industry expenditures: $1.47 per barrel of net crude oil produced in 1944, $2.21 in 1948, and $3.16 in 1953

322. **OIL AND GAS JOURNAL.** Oil Research Cost Rises. Vol. 54, No. 83, Dec. 3, 1956, p. 65.

Even though oil companies spent $161 million in 1955 for research and development, this is still far less than that spent by other major industries. A tabulated breakdown of amounts spent is given for 1954 and 1955.

323. _____. On-Stream Pigging Program Pays Off. Vol. 54, No. 73, Sept. 30, 1956, pp. 165-166.

By constructing permanent internal cleaning facilities one company has improved flow efficiency of nearly 350 miles of 26-inch line. While this improvement program was effective it was also costly. It was estimated that the gas wasted on one job alone cost $65,000 (1954); material, labor and equipment costs were another $53,000.

324. _____. 100 Octane and How It's Made - 42 Processes. Vol. 54, No. 45, Mar. 19, 1956, pp. 149, 155, 159, 170, 176, 177, 180, 183.

In a discussion of these 42 processes the following information is given:

(1) Estimated construction and operating costs for a 5,000 barrel-per-stream-day U.O.P. reformer plant.
(2) Economic summary for a 30,000-barrel Orthoforming Unit.
(3) Operating cost summary for a 10,000-barrel-per-stream-day plant using the combination process - Catalytic Reforming and Feed Desulfurization.
(4) Economics of a typical Gulf Coast Fluid Coking plant with a 10,000-barrel-per-stream-day capacity.
(5) Representative cost figures for the Aluminum Chloride Alkylation process.
(6) Summary of direct operating expense, 98-percent stream factor, for the Perco HF Alkylation process.
(7) Economic evaluation of bauxite treating instead of caustic and water washing, 14,000 barrels per stream day (Alkylation effluent treating).
(8) Brief discussion of investment and operating costs for Pentafining.

325. _____. Refiners Can Save Money with Shell's New Extraction Unit. Vol. 53, No. 36, Jan. 10, 1955, p. 58.

Very briefly describes new rotating disk contactor or RDC used for extracting lubricating-oil fractions. Also has possibilities in caustic or solutizer treatment of high distillates, extraction of aromatics, desphalting, separation of chemical and pharmaceutical-liquid organics, treatment of plant effluents and as a staged chemical reactor. Two different-size RDC units put into service to replace other equipment cost 50 percent less in 1 case and 40 percent less in the other.

326. OIL AND GAS JOURNAL. Sentiment for Crude Price Hike Grows. Vol. 54, No. 46, Mar. 19, 1956, p. 128.

In advocating higher prices for crude-oil speakers at two different technical society meetings quoted the following price figures:

Cost of finding oil: $2.00 per barrel.
Selling price of crude oil: $2.75 per barrel.
More realistic selling price: $4.00 per barrel.
Cumulative wage and salary increases in oil industry since September 1941: $0.68 per hour.
Increase in cost of tubular goods, June 1953-August 1955: 10.2 percent.
Increase in cost of structural steel, June 1953-August 1955: 17.9 percent.
Increase in construction costs, June 1953-August 1955: 11.2 percent.

327. _____. Shale-Oil Future Bright. Vol. 54, No. 8, June 27, 1955, p. 72.

Summarizes an address made by A. C. Rubel, vice president of Union Oil Co., before the Interstate Oil Compact Commission at Denver, Colo. In discussing shale-retorting plant to be built at Parachute Creek, Colo., he cited $75,000,000 as the estimated installation cost for this plant, which will produce 40,000 barrels per day of crude shale oil. A 50,000-barrel-per-day pipeline from Rifle, Colo. to Los Angeles, Calif. (815 miles) designed to transport semirefined, hydrogenated material is estimated to cost $56,000,000.

328. _____. Steam Cracking Extended to Ethane, Propane, Feed Stocks. Vol. 54, No. 35, Jan. 2, 1956, pp. 113-114.

Discusses the steam-pyrolysis process as applied to ethane and propane plants and presents a breakdown of direct operating costs for natural gasoline (26 pounds per square inch Reid vapor pressure), for refinery gas and propane mixture, and for East Texas heavy naphtha. Also presents an overall economic summary for steam cracking on the three aforementioned feed stocks based on 75,000,000 pounds ethylene per year - 90 percent stream efficiency - east coast location.

329. _____. What to Expect From the Steel Hike. Vol. 54, No. 56, May 28, 1956, pp. 82-84.

Discusses possible effects of increase in steel prices on the oil industry and presents a table showing effects of previous increase on various items essential to oil production.

330. _____. What's Behind the Price Cut. Vol. 54, No. 64, July 23, 1956, pp. 64-65.

Discusses effect of a 7-cent-per-barrel price reduction on crude oil in eight West Central Texas counties producing approximately 35,000 barrels per day. These counties were shifted from $2.90 scale to $2.83 scale, which has resulted in four price postings for crude oil in West Texas and New Mexico: Sour crude at $2.77 top; New Mexico sweet at $2.83 top; West Texas sweet at $2.90 top; and West Texas intermediate at $2.83 top. Because of disparities caused by this reduction, it is feared that there will be a chain reaction of "downward adjustments."

331. **OIL AND GAS JOURNAL.** Yearly Crude and Products Prices. Vol. 53, No. 39, Jan. 31, 1955, p. 265.

Four graphs present the following information for five grades of oil: (1) Average crude oil prices for selected grades (at wells) from 1936-1954; (2) petroleum products prices (at refineries) - Midcontinent; (3) petroleum products prices (at refineries) - Gulf coast; and (4) petroleum products prices (at refineries) - eastern seaboard.

332. OLIVE, M. J. Cathodic Protection Teams Up With Water Treatment to Stop Corrosion. Oil Gas Jour., vol. 54, No. 50, Apr. 16, 1956, pp. 220, 223, 224, 227.

Describes dual method - combining cathodic protection and water treatment - used by Arkansas Fuel Oil Corp. to combat corrosion of equipment of water side. Gives material cost of magnesium anodes used in water side of condensers and also discusses savings realized. First year savings ($123) in labor per condenser was realized, and second year savings increased to $150.

333. **OLIVER, JOCK, AND LEAVENWORTH, MAX.** Silicones - New Tools for Petroleum Operations. Oil Gas Jour., vol. 53, No. 19, Sept. 13, 1954, pp. 118-119.

Discusses several field-plant applications of silicone-based paints, and for three examples given, labor and material costs are tabulated.

334. **ONGSTAD, O. C., CHETRICK, M. H., AND OPPELT, W. H.** Cost Data for Gasification of Lignite in an Externally Heated Retort. Bureau of Mines Rept. of Investigations 5272, 1956, 17 pp.

Report gives cost data for an experimental unit and an estimate of synthesis gas cost for a plant producing 50 million cu. ft. of (H_2 + CO) per day.

335. **OSCARSON, G. L., AND KOLAR, R. J.** Enclosures for Protecting Large Motors. Petrol. Eng., vol. 26, No. 11, October 1954, pp. E-20 - E-22.

Discusses reasons for enclosures and principles of ventilation, as well as listing various types of enclosures for protecting large motors. Relative cost ratios given for various types.

336. **OTT, HENRY C.** Nuclear Power Progress - Is Our Program Lagging? Chem. Eng. Prog., vol. 52, No. 12, December 1956, pp. 527-530.

In a discussion comparing progress of United States and Great Britain in nuclear power program, costs of British gas-cooled, graphite-moderated, nuclear power station are given, including capital cost, annual cost, and cost of electricity at 80-percent load factor. Estimates of generating costs for United States pressurized water reactor at Shippingport, Pa., are also tabulated for three different cases.

337. **OTTEN, PHILLIP S.** How to Specify - Heat Exchangers. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 116-118.

Offers suggestions and assistance for preparing specifications for heat exchangers.

338. **OVID, BAKER.** Designing for Simultaneous Flow of Oil and Gas. Oil Gas Jour., vol. 53, No. 12, July 26, 1954, pp. 185-190, 192, 195.

Article is a full report on Magnolia Petroleum Co. research on two-phase pipeline design, including graphs showing various flow patterns, tables of experimental data, and an economic comparison of two-phase and single-phase pipeline investments, based on three different cases.

339. **OWEN, ROGER K.** Capacitors Pay Off in Electrical Beam Pumping. Petrol. Eng., vol. 28, No. 1, January 1956, pp. B-25 - B-26.

Presents economics of motor-switched capacitors and illustrates, in tabular form savings derived from their use in five instances.

340. _____. Save That Pumping Power. Oil Gas Jour., vol. 54, No. 30, Nov. 28, 1955, pp. 103, 106.

Discusses advantages, both in operation and in dollar savings, of using capacitors on electrified beam-pumping units. Tabulation gives savings that resulted from actual experience with five different leases; in one case saving amounted to $1,099 per year.

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341. **PACKIE, J. W., AND CAMPBELL, D. L.** Flexible Refinery Design. Petrol. Proc., vol. 9, No. 12, December 1954, pp. 1881-1884.

Lists five broad points that must be considered in evaluating design flexibility. Investment and operating costs are given in tabular form.

342. **PALMQUIST, W. W.** "Karbate" Impervious Graphite Heat Exchangers. Chem. Eng. Costs Quart., vol. 4, No. 4, October 1954, pp. 111-117.

Description of "Karbate" impervious graphite heat-transfer equipment, including tube- and shell-type exchangers, sectional cascade coolers, immersion-type heat exchangers, and bayonet-type heat exchangers. Costs for various sizes of each type described are tabulated.

343. **PAPPAS, M. A., AND DALTON, J. S.** Correlation of Manpower Requirements, Maintenance Requirements, and Equipment Selection. Petrol. Eng., vol. 26, No. 7, July 1954, pp. C-22 - C-25.

No actual costs given but proves importance of proper equipment selection in keeping operating costs to a minimum.

344. **PARKER, F. DRAKE, AND JONES, H. R.** Don't Forget Markets in Plant Design. Petrol. Refiner, vol. 35, No. 12, December 1956, pp. 187-190.

Consideration of market and economic information, "The Market Concept," should be an integral part of design of process units, so that these units will be flexible, adaptable, and convertible as may be required to meet rapidly changing market situations. Three tables illustrate use and effect of "The Market Concept" as a factor in cost estimating.

345. **PARKHURST, GEORGE L.** The Professional Man: All Branches of Chemical Industry Need Economic Thinking. Ind. Eng. Chem., vol. 47, No. 1, December 1955, pp. 45A-46-A.

In an address before senior and graduate chemical and chemical engineering students, Parkhurst discusses importance of thinking in economic terms in all phases of chemical industry, including research.

Briefly defines simple concepts of various elements comprising overall economics, such as cost of final product, profit, return on investment, and payout.

346. **PARRY, V. F.** Low Temperature Carbonization of Coal and Lignite for Industrial Uses. Bureau of Mines Rept. of Investigations 5123, 1955, 27 pp.

Discusses some technical and economic problems involved in low-temperature carbonization of various coals.

347. **PATON, BRUCE L.** Do Models Pay Out? Petrol. Refiner, vol. 35, No. 11, November 1956, pp. 161-164.

Fluor Corp. justifies use of scale models in savings on design and drafting costs alone, although savings extend to other areas as well. This company saved $100,000 in drafting costs the first year design models were used on every major job, and on 1 job alone $50,000 worth of pipe, fittings, and fabrication was eliminated as the result of a design model. Models cost approximately as follows: For a plant estimated to cost $1 million dollars, model costs about 0.41 percent or $4,000; for a plant in the neighborhood of $30 million, the model costs about 0.05 percent or $15,000.

348. **PATTERSON, A. C., AND JONES, M. C. K.** Hydrofining's Use in Product Improvement. Oil Gas Jour., vol. 53, No. 24, Oct. 18, 1954, pp. 92-94.

Discusses versatility of Hydrofining and describes some of its applications. One table presents approximate costs for Hydrofining as follows:

	Investment, $1,000	Direct operating cost, cents per barrel 1/
Diesel fuel:		
Hydrofining	1,100	15
Hydrogen plant	1,200	5
Cracked naphtha or cracked heating oil:		
Hydrofining	900	13
Hydrogen plant	500	2

1/ Includes operating and repair labor, repair material, catalyst, utilities and fuel.

349. **PAYNE, JOHN W.** When to Use a Pilot Plant. Petrol. Refiner, vol. 35, No. 6, June 1956, pp. 126-128.

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Economic considerations must be taken into account when deciding when to use a pilot plant.

350. **PERKINS, C. S.** Savings Through Standardization. Oil Gas Jour., vol. 53, No. 28, Nov. 15, 1954, pp. 241-243.

Discusses results of a questionnaire regarding standardization of refinery equipment submitted to a number of refiners. Includes savings that could be or have been realized in inventory stocks through standardization.

351. **PERRY, CHARLES W.** The Integration of Engineering Skills in Chemical Plant Construction. Chem. Eng. Prog., vol. 50, No. 8, August 1954, pp. 382-384.

Explains need for greater engineering skill and coordination of the various branches of engineering in design and construction of new chemical process plants, and suggested organization charts to facilitate this coordination.

Varying a great deal, of course, on type and complexity of the job, engineering costs as a percentage of total cost are approximated.

352. **PETROLEUM ENGINEER.** New Process Makes 100-Octane-Number Gasoline. Vol. 27, No. 4, April 1955, p. C-60.

Article describes a new reforming process called Rexforming and gives investment and operating costs.

353. **PETROLEUM PROCESSING.** Arosorb. Vol. 10, No. 8, August 1955, p. 1201.

Summarizes process, with investment and operating costs.

354. _____. Basic Guides for Locating a Petrochemical Plant. Vol. 10, No. 10, October 1955, pp. 1587-1591.

Part 3 - Product Transport Costs, discusses the cost of transportation as a factor in plant site location.

355. _____. Catforming. Vol. 10, No. 8, August 1955, pp. 1182-1183.

Concise summary of process, operating conditions, feed and product properties. Some cost figures.

356. _____. Cyclic Adsorption. Vol. 10, No. 8, August 1955, p. 1202.

Summary of process, giving yields with a breakdown as to investment and operating costs.

357. _____. Extractive Distillation. Vol. 10, No. 8, August 1955, p. 1198.

Summary of chemicals and utilities used and labor and maintenance costs given per barrel.

358. _____. Heat-Exchanger Costs. Vol. 11, No. 3, March 1956, pp. 130-132.

Gives a series of charts in which cost in dollars per square foot of heat-transfer surface is plotted against total amount of heat-transfer surface per shell. Other tables and charts are also given.

359. PETROLEUM PROCESSING. Hyperforming. Vol. 10, No. 8, August 1955, pp. 1194-1195.

Concise summary of process, operating conditions, feed and product properties. Cost figures are given.

360. _____. Iso-Plus. Vol. 10, No. 8, August 1955, p. 1181.

Concise summary of process, operating conditions, feed and product properties. Some cost figures.

361. _____. Kellogg-Sinclair-Baker. Vol. 10, No. 8, August 1955, pp. 1196-1197.

Concise summary of process, operating costs, and feed and product properties.

362. _____. Modified SO_2 Extraction. Vol. 10, No. 8, August 1955, p. 1200.

Summary of process, with investment and operating costs.

363. _____. Orthoforming. Vol. 10, No. 8, August 1955, pp. 1188-1189.

Concise summary of process, operating conditions, feed and product properties. Cost figures.

364. _____. Primary Petrochemicals - Up 19%. Vol. 10, No. 10, October 1955, pp. 1592-1593.

Dales and production figures are given for various crude petroleum and natural-gas products.

365. _____. Platforming. Vol. 10, No. 8, August 1955, pp. 1176-1177.

Concise summary of process, operating conditions, feed and product properties. Cost figures given.

366. _____. Rexforming. Vol. 10, No. 8, August 1955, p. 1180.

Concise summary of the process, operating conditions, feed and product properties. Investment and operating costs given.

367. _____. Sinclair-Baker. Vol. 10, No. 8, August 1955, pp. 1186-1187.

Concise summary of process, operating conditions, feed and product properties. Cost figures given.

368. _____. Thermo for Catalytic Reforming. Vol. 10, No. 8, August 1955, pp. 1192-1193.

Concise summary of process, operating costs, feed and product properties.

369. _____. Udex. Vol. 10, No. 8, August 1955, p. 1199.

Concise summary of process and breakdown of operating costs.

370. **PETROLEUM PROCESSING.** Ultraforming. Vol. 10, No. 8, August 1955, pp. 1184-1185.

Concise summary of process, operating conditions, feed and product properties. Some cost figures.

371. **PETROLEUM REFINER.** Construction Boxscore - Refineries, Natural Gasoline and Petrochemical Plants.

A quarterly compilation, giving company name, plant site, project, daily capacity, estimated cost, status, probable completion date, licenser, engineering, and contractor. This information appears in January, April, July, and October issues. Quarterly references follow:

Vol.	No.	Date	Pages
33	7	July 1954	194-212
33	10	October 1954	184-198
34	1	January 1955	186-202
34	4	April 1955	207-224
34	7	July 1955	203-220
34	10	October 1955	198-206
34	1	January 1956	213-226
34	4	April 1956	249-264
34	7	July 1956	232-248
34	10	October 1956	200-216

372. **PETRY, J. K.** Patterson-Kelley Twin Shell Blenders. Chem. Eng. Costs Quart., vol. 5, No. 3, July 1955, pp. 60-64.

Description of twin-shell blenders and costs for both standard models and intensifier models, with either a plastic shell or a stainless shell.

373. **PFEIFFER, CARL, AND SANDLER, HENRY J.** Ammonia From Cat-Reformer Offgas. Petrol. Refiner, vol. 34, No. 5, May 1955, pp. 145-152.

Gives detailed comparison of six ammonia-synthesis gas preparation processes, based on production costs and operating characteristics.

374. **PHILLIPS, R. J.** New Process for Removing Reformer Feed-Stock Sulfur. Petrol. Refiner, vol. 35, No. 11, November 1956, pp. 202-204.

A new process - electrostatic desulfurization - can economically eliminate H_2S corrosion and catalyst contamination in catalytic reformers. Process cost is estimated to average about one-fifth that of out-of-pocket costs for a comparable-sized hydrodesulfurization plant. Investment costs will approximate $20 per barrel and operating costs less than 1 cent per barrel; maintenance costs are simply those required for routine inspection.

375. _____. The Application of Electrical Precipitation to Distillate Treating. Petrol. Eng., vol. 27, No. 13, December 1955, pp. C-9 - C-12.

A description of use of electrical precipitation as an aid in treating all distillates and an economic justification of a typical plant installation.

376. PIERCE, DAVID E., AND McNEILL, WINFIELD I. Control of Costs in Production. Chem. Eng. Prog., vol. 50, No. 11, November 1954, pp. 552-555.

Outline of a program for effective cost control in production. Graphs showing actual overall savings, savings as a result of increases in material performance, and improvement in labor costs illustrate effectiveness of good cost-control procedure.

377. POETKER, RUPERT H., AND STONE, JOHN D. Inhibition Improved 17 Percent, While Cost Dropped 50 Percent. Oil Gas Jour., vol. 54, No. 62, July 9, 1956, pp. 100-101, 103-105, 107.

Discusses three major problems in controlling corrosion of gas-lift wells and steps taken to overcome these problems. Various types of chemical treatment were tried and method of squeezing an organic inhibitor into production formation seemed to be most effective. A comparison is made of results and costs of wells given batch treatment, of wells given squeeze treatment, and of those wells receiving no treatment. Cost curves are also presented on two different wells where squeeze treatment was employed.

378. POLL, HARRY F. What Unifining Can Do for You. Petrol. Refiner, vol. 35, No. 7, July 1956, pp. 193-198.

The author describes six cases as examples to illustrate what Unifining can do. This process is characterized by relatively low operating and investment costs; for example, the No. 1 and No. 2 Unifiner applications used in the paper have capital investment costs of $100-$150 per barrel, and $150-$175 per barrel, and operating costs of 10 and 12 cents per barrel, respectively.

379. POMINSKI, JOSEPH, DECOSSAS, K. M., EAVES, P. H., VIX, H. L. E., AND POLLARD, E. F. Preliminary Cost Study of Rice Wax Filtration - Extraction. Ind. Eng. Chem., vol. 47, No. 10, October 1955, pp. 2109-2110.

Preliminary cost study of application of modified filtration-extraction process to rice bran as an indication of commercial feasibility of recovering rice wax from rice bran. Flowsheet of the process is given, a material balance for a 100 ton-per-day rice bran processing plant, using modified F-E process, and a table giving estimated additional equipment and costs needed to convert a 100-ton-per-day plant. This preliminary estimate, based on bench-scale data and current equipment costs, indicates that additional investment and operating costs required to produce wax from rice bran are reasonable and that process could considerably increase net income of a rice-oil producer.

380. PONDER, THOMAS C. How to Specify - to Get More Plant for Less Money. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 106-107.

Discusses specifications for process plants and stresses need for giving contractor a clear scope of work involved, preparing accurate specifications, and selecting qualified project engineers.

381. POOR, W. B. Economic Factors and How They Affect Gas-Pipeline Design. Petrol. Eng., vol. 26, No. 12, November 1954, pp. D-48 - D-50.

Discusses factors that must be considered in designing gas pipeline systems. Includes costs for storage.

382. **POORMAN, FRANK.** Modernization of Obsolete Pumping Equipment. Oil Gas Jour., vol. 53, No. 52, May 2, 1955, pp. 93-94, 97.

A major equipment modernization program by 1 large company resulted in an increase in production with 27 less wells and a reduction in operating costs of 45.6 percent. An undeferred net profit of $3,177,000 or 353 percent on investment of $900,000 for modernizing 464 wells is also indicated. A tabulation comparing costs before and after modernization is presented, as well as a graphic presentation of $70,500-per-year reduced lease expense as a result of modernization program. An annual increase of $163,000 is expected from increased oil production and decreased operating expense.

383. **POWELL, SHEPPARD T.** Adaptation of Treated Sewage for Industrial Use. Ind. Eng. Chem., vol. 48, No. 12, December 1956, pp. 2168-2171.

In a discussion of treatment of liquid wastes as a practical solution to industrial water problems, following cost data were presented.

Cost data for use of reclaimed water[1]

Location of user	Type of use	Quantity used, acre-ft./year, (approx.)	Cost, $/acre-ft., (approx.)	Cost of alternative water $/acre-ft., (approx.)
Grand Canyon, Ariz.	Powerplant[2]	200	$120	$650
Los Angeles, Calif.	Sewage plant,[3] Hyperion	12,000		40
Baltimore, Md.	Steel plant, Bethlehem	60,000	[4]4	33
Amarillo, Tex.	Refinery, Texas Co.	1,700	[5]14	45
Big Springs, Tex.	Refinery, Cosden	2,200	16	57

[1] Reproduced by permission of State Water Pollution Control Board.
[2] Effluent also used for irrigation.
[3] Pumping and chlorination are only costs.
[4] Approximate cost does not include additional treatment and pumping, and amortization of $2,000,000 investment.
[5] Does not include amortization costs paid by refinery, which would raise cost to approximately that of city water at minimum use.

384. **PRATT, A. W.** Report to Management: Focusing the "Vision." Ind. Eng. Chem., vol. 47, No. 3, March 1955, pp. 35A-38A.

Survey of preliminary steps involved in constructing a chemical plant - from beginning of idea to final decision to build. These steps include: (1) A thorough market survey, (2) data from pilot-plant operation, (3) plant cost estimation, (4) economic evaluation, and (5) commercial plant financing. Each step is discussed, and charts and tables are used to complement discussion.

385. **PRENGLE, H. WILLIAM, JR., DUKLER, A. E., CRUMP, JOSEPH R., AND NORRIS, BERRY E.** What's the Lower Limit for Gas Processing? Petrol. Refiner, vol. 35, No. 4, April 1956, pp. 141-147.

Discusses skid-mounted gasoline plants and presents an example to illustrate economic feasibility of installing a field gasoline plant.

386. PRIEN, CHARLES H., AND SAVAGE, JOHN W. A Shale-Oil Industry is on Its Way. Chem. Eng. Prog., vol. 52, No. 1, January 1956, pp. 16J-21J.

Discusses feasibility and commercial future of producing oil from oil shale. Presents tabulation giving approximate distribution of costs in oil-shale processing based on data from the N.P.C. and the Bureau of Mines. The cost of partly refined shale oil in California is estimated to be $2.65 per barrel. "Shale petrochemicals," byproducts of shale-oil industry, can be a tremendous economic factor in reducing cost of primary fuel products.

387. PRUTTON, C. F. Plant Management - A Hypothetical Plant Illustrates the Relationship of Total Profit and Maximum Economic Production Rate. Ind. Eng. Chem., vol. 46, No. 9, September 1954, pp. 91A-92A.

Considers major operating cost items encountered in chemical manufacturing and their variation as production rates in a given plant are increased. These major items include labor, utilities, maintenance, raw materials, fixed charges, and profit.

388. PYEATT, W. W. Cost Factors May Control Midget-Plant Design. Oil Gas Jour., vol. 54, No. 71, Sept. 10, 1956, p. 145.

Lists cost factors governing success of midget gasoline plants and tabulates cost items in percentages against choice of a plant to recovery: (1) Gasoline and salable residue gas only, (2) gasoline, residue, and butane, and (3) gasoline, residue gas, butane, and propane.

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389. RAMSEY, ROBERT P. Free-Piston Gas Turbine - 2. How It Compares With Reciprocals. Oil Gas Jour., vol. 53, No. 37, Jan. 17, 1955, pp. 127, 129, 130, 132.

First article in series explained how free-piston gas turbine works and gave some general facts concerning it.[11]

This article makes direct comparison between free-piston unit and a conventional crank-type engine of comparable size, and gives a cost estimate for installing a 5,000 hp. pumping station.

390. RATLIFF, R. A., AND STROBEL, W. B. Use of Sulfur Dioxide for Extracting Benzene and Toluene. Petrol. Eng., vol. 26, No. 12, November 1954, pp. C-26 - C-34.

Article reviews operation of a unique commercial sulfur dioxide extraction process. Includes investment and operating costs.

391. REARICK, J. S. Symposium on "Know-How" Economics. Costs in Developing Process Know-How. Ind. Eng. Chem., vol. 47, No. 5, May 1955, pp. 987-990.

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[11] Ramsey, Robert P., Free-Piston Gas Turbine - 1. How It Works: Oil Gas Jour., vol. 53, No. 35, Jan. 3, 1955, pp. 127-129, 130.

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A discussion of factors affecting equipment and operating costs and a definition of these factors. Unit prices for a few commonly used equipment items are given, with an analysis of typical operation.

392. **REDFIELD, CLIFFORD S., PORT, WILLIAM S., AND SWEEN, DANIEL.** Cost Estimate on Technical-Grade Vinyl Stearate. Ind. Eng. Chem., vol. 47, No. 9, pt. I, September 1955, pp. 1707-1710.

A detailed cost estimate based solely on laboratory data for preparation of vinyl stearate indicates that a plant producing 5,000,000 pounds of vinyl stearate per year should realize a profit, after taxes, from a selling price of 43 cents per pound; at an annual production rate of 10,000,000 pounds, selling price could be as low as 31 to 34 cents per pound. A return of 12 percent on investment, after taxes, is assumed.

393. **REED, PAUL.** American Louisiana Line to Touch Off a Half-Billion-Dollar Gas Expansion. Oil Gas Jour., vol. 54, No. 55, May 21, 1956, pp. 156-159.

Building of American Louisiana long-distance single-line transmission system will reach a total cost of approximately $500,000,000, with $130,000,000 constituting cost of line alone and $8,000,000 for three compressor stations. Mississippi River crossing cost between $2,500,000 and $3,000,000 and Red River crossing will be about $600,000. Average cost of 75 main-line valves, including installation and appurtenances, is $25,000 each, and construction costs on the 30-inch pipeline system will vary from $75,000 to $80,000 per mile.

394. _____. Long Pipeline Wrapped With Plastic Tape. Oil Gas Jour., vol. 54, No. 82, Nov. 26, 1956, pp. 70-72.

Describes first application of plastic tape to a long Big Inch pipeline and its success. Net cost of Polyken tape is $6.90 per square. This high cost is offset by reduction in application costs, which are estimated to include a 45-percent reduction in units of labor required.

395. _____. New Machine Cuts Cost of Padding Pipeline Trenches. Oil Gas Jour., vol. 54, No. 44, Mar. 5, 1956, pp. 88-89.

Describes operating characteristics of a special machine developed to cut cost of padding ditches during pipeline construction. Cost comparisons show that work of padding 26- and 30-inch pipe with this machine would cost about 20 cents per linear foot. Protection of this same-diameter-size pipe with a sheet shield would be about 60-70 cents per foot. Savings from padding machine of $3,800 per day would amount to 66-70 percent. Savings to contractor for padding 100 miles of rocky ditch would be $380,000; for 500 miles the saving would amount to $1,900,000.

396. **REIDEL, JOHN C.** New Plant Will Combine Three Processes. Oil Gas Jour., vol. 53, No. 13, Aug. 2, 1954, pp. 78-81.

Describes processing to be employed in urea and ammonia plant under construction at Pryor, Okla., by Grand River Chemical Division of Deere & Co.

397. **REILLY, JOE.** L.P.G. Storage Hits New Peak. Oil Gas Jour., vol. 54, No. 13, Aug. 1, 1955, pp. 60-63.

Lists Nation's L.P.G. caverns - their size and location, and also summarizes costs of such storage as quoted by representatives of various companies.

398. RESEN, F. LAWRENCE. Concrete Piling Halves Foundation Costs. Oil Gas Jour., vol. 53, No. 22, Oct. 4, 1954, pp. 138-140.

Discusses use of concrete piling rather than solid blocks as foundations for pumps and small vessels in Platformer-Udex unit at Great Southern Chemical Corp. Corpus Christi (Tex.) plant. Results of study employed by Great Southern to determine which type of foundation should be used are presented, including a brief economic comparison between two.

399. _____. What Gulf Refiners Are Thinking. Oil Gas Jour., vol. 54, No. 37, Jan. 16, 1956, pp. 70-71.

A series of questions and answers based on interviews of Gulf coast processors on subject of octane numbers and what it costs to add a number. Effect of a crude-oil price increase is also discussed.

400. RIFENBURG, A. W. Stripper Plant Boosts Pipeline Efficiency. Oil Gas Jour., vol. 54, No. 44, Mar. 5, 1956, pp. 97-98, 100.

Describes installation and operation of absorption-type stripper plant to remove liquids that were condensing and accumulating in pipelines and thereby reducing efficiency of line. Capitalized cost of the plant was $239,949. Gross value of gasoline production was $443,937 in 3-1/2 years, and total operating costs in same period were $130,816. Gross profit in 3-1/2 years was $312,581.

401. ROSEN, B. H., AND REGNIER, A. L. Economics and Research Programing. Chem. Prog., vol. 52, No. 12, December 1956, pp. 500-502.

In a properly functioning research organization the number of projects should exceed availability of personnel and facilities. Article discusses in detail a method for project evaluation similar to a system used by Cities Service & Development Co. Brief mention is made of other types of methods for project evaluation and limitations of each.

402. RUDEL, JOHN C. Natural Gas to Acrylonitrile. Oil Gas Jour., vol. 54, No. 18, Sept. 5, 1955, pp. 110-113.

Describes American Cyanamid's new Fortier plant that employs direct acetylene-HCN process. The plant cost is $50,000,000 and plant capacity 50,000,000 pounds per year of highly pure acrylonitrile. Briefly, cost history of acrylonitrile has been as follows: After the end of World War II, product fell to as low as 25 cents per pound, but with cost of raw materials and labor rising, price went up to 43 cents per pound. Development of direct acetylene-HCN process led to prediction of a cost figure of 31 cents per pound. Actually, however, present tank-car prices are 27 cents per pound and indications are that price seems stabilized at that figure for time being.

403. RUGNA, ERNEST A., AND BRUINS, PAUL F. Recovery of Aconitic Acid From Molasses. Ind. Eng. Chem., vol. 48, No. 8, August 1956, pp. 1268-1277.

A discussion of three processes - methanol precipitation, solvent extraction, and ion exchange - for recovering aconitic acid and comparison of economics of each. Preliminary cost estimates were made for each process, including utilities and chemicals costs based on 1 ton of aconitic acid and installed-equipment costs for plants producing 1,000,000 and 4,000,000 pounds per year.

A solvent-extraction plant producing 1,000,000 pounds per year was used as a basis for example illustrating how fixed-capital estimates were made and also to illustrate method of calculating total costs for each process.

Manufacturing costs per ton of aconitic acid for each process are as follows:

	1,000,000 lb./year	4,000,000 lb./year
Methanol	$696.93	$520.49
Solvent extraction ...	623.08	440.68
Ion exchange	718.74	531.01

404. **RUSSELL, J. T.** Chemical Costs Drop Sharply in This Installation for Automatic Treating of Cooling Water. Oil Gas Jour., vol. 53, No. 10, July 12, 1954, pp. 109-110.

Describes fully automatic installation for treating cooling water which uses only sulfur (burned to SO_2) and corrosion inhibitor. Chemical cost for treating 1,000 gallons of water is $0.60 for sulfur and $1.50 for corrosion inhibitor in a gasoline plant, and $0.69 for sulfur and $1.50 for corrosion inhibitor in a compressor station.

405. **RUSSELL, R. J.** Dryers and Drying Costs. Chem. Eng. Costs Quart., vol. 5, No. 4, October 1955, pp. 96-104.

Article is limited to driers used in removing water from solid material by vaporization. Driers are classified by temperature range, and criteria are given for their selection. Drying costs are discussed in two categories: (1) Fixed charges, based on installed cost of the dryer and any necessary auxiliary equipment; and (2) operation cost, including (a) fuel, (b) power, (c) operating labor, and (d) maintenance (materials and labor).

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406. **SAMANIEGO, J. A., AND NELSON, C. R.** Cost Estimation in the Development of a New Process. Chem. Eng. Prog., vol. 52, No. 11, November 1956, pp. 471-473.

A case history from files of Shell Development Co. reveals that four cost estimates are prepared in process-evaluation work, that is, screening-cost estimate, preliminary cost estimate, process-cost estimate, and finally, plant estimate when a process is approved for construction. These four stages in cost estimating are illustrated by Shell's experience in evaluating a proposed new process against an existing process.

407. **SAVARDI, GEORGE, JR.** Impervious Graphite Equipment - Applications and Costs. Chem. Eng. Costs Quart., vol. 6, No. 3, July 1956, pp. 56-64.

Application of impervious graphite in chemical processing industries, with a brief description of certain equipment fabricated from impervious graphite. Cost data are given for eight pieces of equipment described.

408. SCHEEL, L. F. Development of the Modern Gas-Engine Compressor Plant. Petrol. Eng., vol. 26, No. 13, December 1954, pp. D-45 - D-54.

Summarizes investment and operating costs for compressor plants.

409. SCHOFIELD, BRYCE P. How Plant Costs Vary With Size. Chem. Eng., vol. 62, No. 10, October 1955, p. 185.

Author discusses why rule of thumb "six-tenths factor" for estimating investment costs does not apply in cost estimates for an electrolytic chlorine-caustic soda plant. Because roughly half cost of such a plant is cost of cell installation, slope of a cost-capacity curve should approach 1.0. Rest of the cost would normally follow 0.6 rule. Therefore, total cost should vary with size by some factor midway between 0.6 and 1.0, and in a graph plotted by author slope of line is 0.75.

410. SCHUMAN, S. C. How Plant Size Affects Unit Costs. Chem. Eng., vol. 62, No. 5, May 1955, pp. 173-176.

Using relationship that bigger plants mean lower unit costs, a quantitative analysis is made of this relationship for average chemical.

411. SCHUTT, H. C., AND ZDONIK, S. B. Compression and Pretreatment of Pyrolysis Product. Oil Gas Jour., vol. 54, No. 60, June 25, 1956, pp. 92-97.

As one of series of articles describing making of ethylene, this article is devoted to detailed considerations involved in compression and pretreatment of pyrolysis products. In discussing choice of compressors two hypothetical plants are assumed, and by summarizing cost studies advantage of reciprocating unit over centrifugal unit is shown in one instance, while reverse advantage is shown in second case.

412. _____. What Are Feed Stocks, Yield, Costs, in Ethylene Production? Oil Gas Jour., vol. 54, No. 41, Feb. 13, 1956, pp. 98-103.

Discusses feed stocks - byproduct refinery gas, ethane, propane, butane, commercial LPG, natural gasoline, light refinery fractions, and crude oil (distillate) fractions; the two processes for obtaining the best yields - pyrolysis and selective cracking; and the costs for ethane cracking, propane cracking, and N-butane cracking. In a more general way, discusses the cracking of light distillates, of kerosine and gas oils, and of residual oils.

413. SCHWAB, LEONARD, AND EARNHEART, B. G. Cut Repair Time and Costs With Alert Design. Chem. Eng., vol. 63, No. 10, October 1956, pp. 190-194.

Factors to consider in designing for lower maintenance cost.

414. SCOTT, P. P., JR., AND LUMMUS, J. L. Cyclones Save Barite, Reject Clay Solids. Oil Gas Jour., vol. 54, No. 75, Oct. 8, 1956, pp. 188-189, 192-193, 195-196, 201.

In laboratory and field tests using cyclones to remove clay solids while reclaiming barite from drilling muds, 1 company realized savings on chemicals of \$8,700 in 14 days on 1 well and \$10,000 in 3 days on another well, in addition to more efficient operation. Performance of the cyclones used in laboratory tests is tabulated and the resultant savings of this treatment as compared with jetting are shown, percentagewise and dollarwise.

415. SCOTT, T. L. How Can You Reduce Maintenance Costs on Electric Beam-Pumping Motors? Oil Gas Jour., vol. 53, No. 37, Jan. 17, 1955, pp. 105-106.

Discusses following items: (1) Proper selection and installation of equipment; (2) realistic measurement of maintenance requirements; (3) complete organizing and scheduling of maintenance operations. They are three primary factors leading to quality-low-cost maintenance. One company was able to determine savings in maintenance costs by actually comparing two different areas - one that followed a well planned program and another that did not. Maintenance costs of \$3.25 per motor per month and \$6.30 per motor per month, respectively, were noted, or an estimated annual saving of \$58,600 based on 1,600 beam-pumping motors.

416. SEAGRAVE, E. M. Condensate Control Saves Capital Cost. Chem. Eng., vol. 62, No. 4, April 1955, p. 210.

A sketch compares conventional arrangement against an unconventional but useful method for temperature control of a steam-liquid heat exchanger. This latter method results in a considerable saving in capital investment.

417. SEE, WALTER GEORGE. Submerged Combustion Equipment. Chem. Eng. Costs Quart., vol. 4, No. 4, October 1954, pp. 118-122.

Explanation of submerged combustion, applications of submerged combustion equipment, and costs for heating water by submerged combustion as compared with more conventional methods.

418. SENGSTAKEN, DONALD J., AND DURHAM, EDWIN. LMFR Fascinates ChE's. Chem. Eng., vol. 63, No. 3, March 1956, pp. 114-115.

Report by authors to Nuclear Engineering Congress on work done by a 10-man team at Brookhaven National Laboratory in developing liquid-metal-fuel reactor. Based on a capital cost estimate for a 200-megawatt station, estimated energy cost would be 7.5 mills per kilowatt-hour, thus making an LMFR powerplant economically competitive with many fossil-fuel-fired power stations.

419. SHERWOOD, PETER W. Status Report on Partial Oxidation of Ethylene. Petrol. Proc., vol. 9, No. 10, October 1954, pp. 1592-1599.

Summarizes technology and economics of ethylene oxidation.

420. SHIELDS, C. H., JR. Filtering Trace Metals From No. 6 Fuel Oil - 2. Oil Gas Jour., vol. 54, No. 49, Apr. 9, 1956, pp. 123-124.

First in this series of articles described removal of trace metals in No. 6 fuel by filtration, using a model continuous rotary vacuum filter.[12]

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[12] Shields, C. H., Jr., Filtering Trace Metals From No. 6 Fuel Oil - 1: Oil Gas Jour., vol. 54, No. 47, Mar. 26, 1956, p. 157

This article gives test data and results and also converts operating data into cost figures for purposes of preliminary economic evaluation. These cost figures indicate that process is economically feasible.

421. SHIRA, W. S. Vibrating Screens. Chem. Eng. Costs Quart., vol. 6, No. 3, July 1956, pp. 74-79.

Discusses types of vibrating screens and provides a guide for selecting proper screen for various applications in chemical industry. Based on a single-deck screen, used under certain conditions, approximate cost of vibrating screens as a function of capacity is given. Costs are based on prices prevailing as of March 1956.

422. SHOCKLEY, HENRY. New Look in Maintenance. Chem. Eng., vol. 61, No. 12, December 1954, pp. 187-190.

"Engineered maintenance" as answer to cost reduction in chemical plants and determination of maintenance workload in designing new plants.

423. SKAFF, P. S. Maintenance - Today's Top Challenge. Oil Gas Jour., vol. 54, No. 80, Nov. 12, 1956, pp. 176-178, 180-182, 184.

Analyzes maintenance function in large industrial plants and shows that portion of the cost-of-production dollar attributable to maintenance is growing at a faster rate than are other elements of cost. Operating investment per capita has almost doubled in 10 years. Presents a discussion on how costs are controlled in one industrial plant by using a "job-order-account system," maintaining cost goals, and systematically reviewing performance against goals. A breakdown is also given of (1) mechanical maintenance, (2) instrument maintenance, and (3) electrical maintenance, and their percentages as related to total maintenance. For example, mechanical maintenance is 78 percent of total maintenance, instrument is 15 percent and electrical is 7 percent.

424. SKINNER, M. E. Resources West North Central: Electric Power Resources. Ind. Eng. Chem., vol. 46, No. 11, November 1954, pp. 2315-2319.

This article reviews characteristics of area, population, and natural and electrical power resources of the seven States comprising West Central States as a unit. Characteristics of this area are compared with United States as a whole, with particular emphasis on highly coordinated and ample power resources now available to area for supply of power to industries that may be interested in this location.

425. SKOLD, R. V., AND WILKES, J. F. Monobed Operation With a Problem Water. Ind. Eng. Chem., vol. 47, No. 1, January 1955, pp. 90-96.

Description of a mixed-bed deionizer installation to supply high-quality water for chemical laboratory service. Four years of operation reveals that this installation delivers water of consistently high purity and operating and maintenance costs are well below former costs of still maintenance. A comparative cost tabulation is given reflecting cost advantages.

426. SMITH, A. B. Subcritical Reactor is Useful for Research and Training. Nucleonics, vol. 14, No. 11, November 1956, pp. 81-83.

Subcritical or exponential reactor is described, and brief cost figures are given.

427. SMITH, A. C. The How and the Why of Surge Protection. Oil Gas Jour., vol. 54, No. 72, Sept. 17, 1956, pp. 233-237.

Discusses pulsation and pressure surge as one of serious pipeline operating costs. One solution of surge problem has been installation of dual pulsation dampeners and a suction surge chamber combination that costs approximately $600 per pump. Principal cost advantages ot his method are: (1) Reduction in initial unit pump cost from $19.70 to $12.50 per barrel per hour of pump capacity, (2) reduction in capital investment from $21,000 to $14,000, (3) reduction in cost of welding fittings and valves and in overall installation cost, both material and labor.

428. _____. More Gross Profit With Minimum Investment. Oil Gas Jour., vol. 53, No. 20, Sept. 20, 1954, pp. 169-170, 240-242.

By citing specific examples, author illustrates that increased efficiency in crude-oil gathering systems can earn additional gross-profit dollars. Discussion is confined to eliminating operating and maintenance expense dollars, although other opportunities to eliminate expense dollars can be found elsewhere. In addition to specific examples given (with savings shown in dollars and cents), other potential sources of increased gross-profit dollars are listed.

429. _____. Ridding Process Waters and Caustic Solutions of Sulfides. Oil Gas Jour., vol. 54, No. 62, July 9, 1956, pp. 95-96, 98-99.

Describes air-oxidation process developed by Shell Oil Co., which makes possible disposal of sulfide-bearing waters without pollution of either atmosphere or surface waters. Utility charges for 3,000-barrel-per-day Unit I now in operation at Shell's Los Angeles refinery are approximately $30 per day, of which the $20 per day for compressed air is largest portion. This 3,000-barrel-per-day Unit I was converted from stream stripping to air operation at relatively low cost of $15,000.

430. SMITH, A. N. How Effective Is Your Maintenance Dollar? Part 1 - Evaluate Your Current Reports. Petrol. Refiner, vol. 35, No. 1, January 1956, pp. 104-107.

Gives methods of evaluating maintenance organization, including a method for analyzing equipment costs.

431. _____. How Effective Is Your Maintenance Dollar? Part 2 - Evaluate by Work Sampling. Petrol. Refiner, vol. 35, No. 2, February 1956, pp. 135-137.

Describes use of statistical activity sampling to determine amount of time spent on job in actual work.

432. _____. How Effective Is Your Maintenance Dollar? Part 3 - Evaluate by Craft Measurement. Petrol. Refiner, vol. 35, No. 3, March 1956, pp. 225-226.

Describes a method to measure effectiveness of the maintenance worker. (See parts 1 and 2.)

433. SMITH, ENNIS C. How to Specify - Cooling Towers. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 125-129.

Offers suggestions and assistance for preparing specifications for cooling towers.

434. SMITH, G. BYRON. How Accounting Was Set Up. Petrol. Eng., vol. 28, No. 11, October 1956, pp. D-57 - D-60.

Describes cost-accounting methods during construction of Pacific Northwest pipeline.

435. SMITH, GEORGE A. Getting at Your Handling Costs. Chem. Eng., vol. 62, No. 2, February 1955, pp. 193-194.

Discusses steps required to establish a trend study that will reveal whether handling costs are going up or down, as well as a list of items that determine handling costs and three main factors that enter into such costs.

436. SMITH, R. B., AND DRESSER, THORPE. Some Economic Considerations in Process Design. Chem. Eng. Prog., vol. 51, No. 12, December 1955, pp. 544-546.

Discusses how best to balance increased investment against expected additional savings or profit such investment will yield.

437. SMITH, R. B., AND EDISON, R. R. What Are Heater Tubes Worth? Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 133-140.

Considers three aspects of tube design - optimum heater-tube wall thickness, optimum corrosion allowance, and optimum tube temperature - to determine correct investment in heater tubes to realize proper return on money spent.

438. SMITH, S. P. The Selection of a Plant Site. Chem. Eng. Prog., vol. 51, No. 3, March 1955, pp. 134-138.

Discusses factors influencing the selection of a plant site for a process industry and the six steps involved in making the selection.

439. STANKIEWICZ, E. J. How to Estimate Stack Costs. Chem. Eng., vol. 62, No. 6, June 1955, pp. 234-244.

Presented in a series of graphs are material requirements for steel, brick, and concrete stacks - their supports, foundations, and linings. Also given are current price ranges for these materials.

440. STANLEY, L. F., AND WILLIAMS, E. C. Two-Way Radio Is Star Performer. Oil Gas Jour., vol. 54, No. 86, Dec. 24, 1956, pp. 75-77.

Describes two-way radio system installed in one large refinery that has proved to be one of more attractive cost-reduction items introduced by materials-handling committee. General cost data for this installation are summarized, maintenance costs cited, and possible economies listed.

441. STEEL, R. A., BOCK, J. A., HERTWIG, W. R., AND RUSSUM, L. W. Factors in Selecting a Catalytic Reforming Process. Petrol. Eng., vol. 27, No. 2, February 1955, pp. C-25 - C-32.

Makes economic comparisons for three types of catalytic reforming processes. Discusses costs, yields and quality, and feed characteristics.

442. STEINER, ROBERT H. Modified Styrene for Structural Applications. Ind. Eng. Chem., vol. 47, No. 7, July 1955, pp. 1307-1311.

Discusses history of development and applications of styrene polymers and includes physical properties and chemical resistances of several styrene plastics and gives their cost in cents per pound.

443. STEPHENS, IRLENE POEMER. In Chemical Industry Cost Estimating. Ind. Eng. Chem., vol. 48, No. 10, October 1956, pp. 32A-33A.

Discusses need for cost estimating and who should be concerned with preparation of a cost estimate; defines terms used in describing economics research, such as "capital investment," "manufacturing cost," and "general expenses," and components of each.

444. STERN, ARTHUR L. Jaw and Gyratory Crushers. Chem. Eng. Costs Quart., vol. 6, No. 2, April 1956, pp. 50-51.

Includes typical size and cost data for jaw crushers and gyratory crushers and briefly describes these size reduction units.

445. STILLSON, PAUL. Application in the Chemical Industries. Ind. Eng. Chem., vol. 48, No. 3, March 1956, pp. 402-407.

A research project conducted by an operations research team (of which author was a member), in which formal optimization techniques are applied to production scheduling and inventory controls.

Detailed account of process conceptualization for a fermentation operation from statement of problem to construction of a general cost equation in terms of pertinent variable factors. Scheduling for 3 years preceding study shows that this method results in substantial savings.

446. STIRLING, J. C. Best Pipeline Is the Straightest One. Oil Gas Jour., vol. 53, No. 28, Nov. 15, 1954, pp. 217-218, 220-221.

Discusses results of a study to reduce number of bends required in a pipeline and advantages gained. A bending machine costs $15,000 plus rental (1/2 cent per foot) of shoe, which cannot be purchased. In addition, process requires a tractor, a foreman, 2 operators, and 5 other men - a total of 7 or 8 men at about $26 per day per man, plus insurance.

447. _____. Why Bend Pipe? Petrol. Eng., vol. 26, No. 13, December 1954, pp. D-26 - D-32.

Points out ways in which number of pipe bends in a piping system can be reduced. Brief discussion of cost of renting a pipe bender and labor costs involved.

448. STOCKDALE, W. G. Estimating Costs for Radiochemical Plants. Chem. Eng., vol. 63, No. 4, April 1956, pp. 185-187.

Discussion deals primarily with methods of estimating cost of a radiochemical plant, complete with necessary auxiliaries. Material is based on facilities built and operated for AEC by private concerns.

Two tables are included, one giving capital-cost and operating-cost distribution and the other presenting estimating factors to consider.

449. STOLLER, S. M. Site Selection and Plant Layout. Nucleonics, vol. 13, No. 6, June 1955, pp. 42-45.

Shows difference in cost between exclusion-area and containment approaches to safety in designing a nuclear powerplant.

450. STORMONT, D. H. Convenient Chart Aids Mud-Study. Oil Gas Jour., vol. 54, No. 75, Oct. 8, 1956, p. 182.

Presents chart developed by Oilwell Research, Inc., on which to record mud data to be translated into cost information which can be applied in future drilling.

451. _____. Monolithic Design Cuts Cost of Packaged T.C.C. Plant Construction. Oil Gas Jour., vol. 53, No. 27, Nov. 8, 1954, pp. 142-143.

Describes design and operation of a streamlined structure for Thermofor catalytic cracking units and saving that can be realized. For example, on a 10,000-barrel packaged unit saving may be as much as $500,000. Overall reduction in cost as a result of this redesigning is expected to range between 10 and 20 percent.

452. STORMONT, D. H. New-Type Pressure Filter Proves Worth at Russell Ranch. Oil Gas Jour., vol. 54, No. 54, May 14, 1956, pp. 126-127.

Describes features of a new-type, low-cost pressure filter designed for handling large volumes of oil-field brines. A chart shows the filtration costs when operating at 14,760 barrels daily. Based on a 10-year life total costs were estimated to be 1.3 mills per barrel.

453. _____. Railroads May Adopt New Fuel Pattern. Oil Gas Jour., vol. 54, No. 42, Feb. 20, 1956, pp. 84-85.

Describes preliminary tests being carried out by Southern Pacific Railroad with dual-fuel system on its diesel locomotives. This system permits a locomotive to switch from diesel to a residual-type fuel during medium and high load conditions. One big advantage foreseen thus far is reduction in fuel costs. Operating full time on a straight-run distillate generally costs about 10.3 cents per gallon, or on a 50-50 blend of cracked and straight-run fuel costs about 9 cents per gallon, while, with the dual-fuel system, the light residual consumed 90 percent of the time costs only 7 cents per gallon.

454. _____. Steam Plant Uses Distilled Sea Water. Oil Gas Jour., vol. 54, No. 83, Dec. 3, 1956, pp. 131-132.

Describes what is believed to be first successful industrial use of seawater distillation in the United States and compares cost of using sea water with well water for this purpose.

455. STORMONT, D. H. Washington Gets First Major Refinery. Oil Gas Jour., vol. 53, No. 41, Feb. 14, 1955, pp. 113-117.

Discusses, in some detail, General Petroleum's Ferndale (Wash.), refinery. Gives total refinery cost: $38,000,000 for a 35,000-barrel-per-day plant; waste-water treating system cost: $1,250,000; and cost for ultramodern fire-protection system: $300,000.

456. STOSTNY, E. P. Electrostatic Precipitators. Chem. Eng. Costs Quart., vol. 6, No. 2, April 1956, pp. 32-36.

Outlines three principal applications of electrostatic precipitators and operating conditions. Discussion of equipment costs and operating costs pointed out that maintenance costs for electrostatic precipitators are very low and that these units have lowest draft losses of any commercially available gas-cleaning equipment.

457. STRATMEYER, R. J. Your Key to Maintenance Savings. Chem. Eng., vol. 62, No. 9, September 1955, pp. 173-178.

Because maintenance is a complex, expensive necessity, there is a continuing search for key to its cost reduction and control. Maintenance costs are divided into two groups, repair and nonrepair items, each group falling into several general categories. Author describes "group" system and "job-order" system of maintenance and advantages of each, analyzing costs.

458. STRETZOFF, S. Today's Commercial HNO_3, Processes: A Critical Comparison. Chem. Eng., vol. 63, No. 5, May 1956, pp. 170-174.

Comparison based on cost of installation and operating costs of three-process schemes for ammonia oxidation and absorption of resulting nitric oxides to arrive at an appropriate selection.

459. STRONG, A. K. Shipping in Larger Unit Loads. Chem. Eng., vol. 62, No. 8, August 1955, pp. 178-180.

Discusses economics of shipping raw materials in larger unit loads to reduce receiving and handling costs and illustrates by using a typical situation involving movement of dry, granular, free-flowing materials.

460. STRYKER, JOHN E. How to Specify - Compressors. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 119-124.

Offers suggestions and assistance for preparing specifications for compressors.

461. STUEVE, W. H. Buy Power, or Make Your Own. Oil Gas Jour., vol. 54, No. 86, Dec. 24, 1956, pp. 65-68.

Gives a list of questions which must be answered to determine whether to use purchased or privately generated power (mechanical power). Considers aspects of application engineering, economics, materials, equipment, and construction costs to illustrate how a decision may be reached and provides tables and graphs.

462. SULLENGER, H. E. Back-Pressure-Control Motor Valve. Petrol. Eng., Ref. Ann., vol. 26, No. 8, July 15, 1954, p. C-9.

Shows how to install a back-pressure-control motor valve for greater efficiency and savings. Gives brief cost figures.

463. SWANTON, W. F. How to Specify - Columns. Petrol. Refiner, vol. 35, No. 10, October 1956, pp. 113-115.

Offers suggestions and assistance for preparing specifications for columns.

464. SWEARINGEN, JUDSON S. Estimating Research Cost. Petrol. Refiner, vol. 35, No. 6, June 1956, pp. 124-125.

Lists steps in estimating cost of a research program and gives example.

465. SWEET, E. ROY. Preparation of Operating Cost Estimates. Chem. Eng. Prog., vol. 52, No. 5, May 1956, pp. 179-182.

Defines operating-cost estimate and various elements that comprise such an estimate. Also gives various ranges of percentage for different components and includes a sample form for a typical operating-cost estimate.

T

466. THEIS, WILLIAM T. How New Internal Coatings Are Proving Their Worth. Oil Gas Jour., vol. 54, No. 41, Feb. 13, 1956, pp. 151-153.

Describes use of internal plastic coatings in pipelines as a solution to problem of internal corrosion and deposition; based on actual case histories cites saving as follows:

Case A - Cost of cleaning and coating - $18,746.
Cost of a replacement - $90,000 - $100,000.
Case B - Cost of laying a line in 1942 - $1.25 per foot.
Total charge against an unprotected line - $3.25 per foot.
(Without protection, replacement necessary in 1951 and in 1960.)
Coating at $0.25 per foot in 1947.
Total charge against a protected line - $1.50 per foot.
Savings realized - $1.75 per foot.

467. THOEN, J. O. Modern Accounting Helps Control Maintenance Costs. Petrol. Refiner, vol. 33, No. 11, November 1954, pp. 183-185.

Discusses ways accounting department can assist in maintenance control.

468. THOMPSON, B. J. A Look at Hydraulic Rich-Oil Motors. Oil Gas Jour., vol. 54, No. 81, Nov. 19, 1956, pp. 24, 247, 248, 250, 253.

Discusses application of hydraulic rich-oil turbines to various oil operations; quotes delivered costs ranging from $20 to $210 per rated horsepower of various units for rich-oil service; a 40 hp. displacement unit, delivered, costs $67 per horsepower, and a 100-hp. centrifugal unit, delivered, costs $57 per rated horsepower.

469. **TIELROOY, JACK.** The Importance of Complete and Accurate Capital Cost Estimates. Chem. Eng. Prog., vol. 52, No. 5, May 1956, pp. 187-190.

Analysis of discrepancies between economic evaluations and actual profit histories. Author believes factor that has greatest effect on estimated profitability is estimate of total capital-investment requirements. A check list containing primary elements of capital investment in process-industries projects is given, with each element explained in detail.

470. **TONN, WILLIAM H., JR.** How the Competitive Urea Processes Compare Today. Chem. Eng., vol. 62, No. 10, October 1955, pp. 186-190.

Compares various processes for manufacturing urea. Manufacturing costs vary from $66.40 to $79.26 per ton.

471. _____. Today's Processes are Compared. Chem. Eng., vol. 61, No. 11, November 1954, pp. 157-160.

Based on prediction that demand for synthetic phenol will perhaps double or triple, Tonn has compared, technically and economically, all six processes for producing synthetic phenol.

His analysis shows that, technically, yields are highest from the caustic process; economically, the cumene process looks best, although lacking in market flexibility.

472. **TUCKER, WILLIAM E.** Want Refinery Costs Quickly? Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 101-105.

Based on 10 years of experience in refinery construction, Caltex Group of companies arrived at a system for collecting costs which permits quick estimating. Caltex system is described in detail with accompanying graphs, tables, and charts to implement author's explanation of method.

U

473. **UHL, WILLIAM C.** Combustion Control = Less Fuel. Petrol. Proc., vol. 9, No. 8, August 1954, pp. 1200-1203.

Discusses results of program aimed at reducing excess air in flue gas. Gives savings and cost of oxygen-analyzing equipment.

V

474. **VANDERPOOL, HOWARD.** Metallizing May Be for You. Chem. Eng., vol. 61, No. 7, July 1954, pp. 189-194.

Examples of successful application of metallizing (in contact sulfuric acid plants, atomic plants, breweries, etc.) as a means of preventing corrosion. More extended use of metallizing systems. Tabulation showing actual metallizing costs is presented and explained.

475. **VAN DYKE, BINGHAM H., AND DOUGHERTY, W. J.** Cost of Low-Temperature Processing. Chem. Eng. Prog., vol. 51, No. 4, April 1955, pp. 157-161.

Discusses factors that affect selection of a particular air-separation cycle and their effect on cost to create a better understanding of low-temperature processing. Approximate equipment cost distribution is given for high- and low-pressure oxygen plants and a mean plot of capital cost per ton daily rated capacity of more than 800 oxygen plants built by Air Products, Inc. These last data are replotted with addition of fixed charges, labor, utilities, supplies, and maintenance.

476. VAUGHN, A. L. Centrifugal Compressors Find Their Place. Oil Gas Jour., vol. 54, No. 77, Oct. 22, 1956, pp. 91-93.

Discusses advantages of centrifugal compressors and graphically presents operating-cost comparison between gas turbines and reciprocating engines which shows savings resulting from use of former. Based on actual experience, a lower investment cost is required for centrifugal-compressor installation, a major saving can be realized on operating labor, and a lower fuel cost has been recorded.

477. VOLKENING, V. B., AND WILSON, J. T., JR. Method for Finding Comparable Paint Costs. Chem. Eng., vol. 63, No. 8, August 1956, pp. 248-250.

Authors prepared a nomograph that permits an accurate comparison between different coating materials which is not possible from price per gallon alone.

478. VOZNICK, H. P. Horizontal Processing Equipment. Chem. Eng. Costs Quart., vol. 6, No. 1, January 1956, pp. 11-16.

Principal use of horizontal processing equipment is handling materials of high consistency. Costs and dimensions are compared for horizontal and vertical fan units. Costs are also given for a number of other units, which are grouped into five different design schemes.

W

479. WAGGAMAN, WILLIAM H., AND RUHLMAN, E. ROBERT. Conservation Problems of the Phosphate Industry. Ind. Eng. Chem., vol. 48, No. 3, pt. I, March 1956, pp. 360-369.

A discussion of conservation problems and need for improved mining, beneficiation, and processing techniques to conserve phosphate reserves.

Cost of raw materials required to produce 1 ton of phosphorus pentoxide as phosphoric acid is estimated to be $61.51 by the sulfuric acid process and $54.65 by the electric furnace method.

480. WAGNER, C. B. Converting New Plants for New Products. Ind. Eng. Chem., vol. 46, No. 12, December 1954, pp. 2466-2471.

Experience of one company tends to prove that chemical process plants are versatile and flexible and can therefore be adapted or altered for uses other than those for which they were originally designed. In a conversion of this type following factors must be evaluated: (1) Raw-materials supply, (2) elimination of freight costs, (3) possibility for expansion, (4) existing equipment that can be utilized and its physical condition (5) equipment that must be purchased, (6) arrangement and location of existing equipment, (7) availability of utilities, (8) condition of land surface, (9) transportation facilities, (10) labor supply, (11) legal restrictions, (12) piping, and (13) cleanout costs.

481. **WAGNER, ERROL R.** How to Maintain Compressors. Petrol. Refiner, vol. 33, No. 10, October 1954, pp. 147-151.

Discusses a program for maintenance of compressors in a natural gasoline plant. Gives investment costs in brief.

482. **WALKER, R. L., AND TAPPMEYER, R. A.** Operation of Duplex Slush Pumps in Parallel. Oil Gas Jour., vol. 53, No. 27, Nov. 8, 1954, pp. 154-156, 158, 160, 162.

Describes characteristics of operation of two medium-size slush pumps in high-speed and high-pressure parallel applications and tabulates saving possible by proper pump phasing.

483. **WALTERS, HOWARD.** New Unit Triples Dehydration Efficiency. Oil Gas Jour., vol. 54, No. 72, Sept. 17, 1956, pp. 169-170.

Describes new wellhead dehydration unit that removes more than three times usual amount of water per pound of chemical and gives operating and maintenance costs.

484. **WARD, CARLTON J., JR.** A Look at Atomic Energy From the Investment Viewpoint. Mines Mag. (Colo.), vol. 44, No. 9, September 1954, pp. 17-21.

Gives brief history of events leading up to development of atomic energy, with costs and technical features of several types of reactors.

485. **WARD, D. G.** Economics of Chemical Transportation. Ind. Eng. Chem., vol. 47, No. 6, June 1955, pp. 1186-1188.

Statistics on transportation network of United States, including fact that estimated cost of transportation is $90 billion dollars annually, or 25 percent of entire produced wealth of the Nation. Discusses importance of these costs to chemical industry, with their effect on location of new chemical-plant sites. Includes a detailed discussion of freight-rate structure as one important aspect of transportation.

486. **WATTS, J. C.** How In-Place Plastic Coating Performs in Field Service. Oil Gas Jour., vol. 53, No. 25, Oct. 25, 1954, pp. 137-138, 140.

Describes procedures to follow for ultimate successful in-place coating and compares maintenance cost for 1 year before coating with cost of coating 4 lines.

487. **WEAVER, JAMES B.** Chemical Cost and Profitability Estimation - 1955. Ind. Eng. Chem., vol. 48, No. 5, May 1956, pp. 934-942.

Review of published data and techniques for estimating chemical engineering, capital investment, manufacturing cost, and profitability. Almost complete series of bibliographies, for both chemical manufacturing and petroleum refining; covers publications through 1954, classified as follows:

Original from THE OHIO STATE UNIVERSITY

Unit Operations - Investment and Operating-Cost Data.
Auxiliary Equipment - Investment and Operating-Cost Data.
Estimation of Manufacturing-Cost Items - Data and Techniques.
Techniques for Improving Product-Cost and Investment Estimates.
Techniques for Expressing Profitability.
Estimated Chemical-Product Data - Investment and Operating Costs.
Estimated Petroleum-Refining Data - Investment and Operating Costs.
Cost-Index Data - Equipment, Labor, Construction.
General - Books and Compilations.
Bibliographies and Subject Indexes.
Miscellaneous.

488. WEAVER, JAMES B. More Help in Finding Cost Data. Chem. Eng., vol. 62, No. 6, June 1955, pp. 247-252.

Author brings up to date his survey of the cost estimating-engineering economics literature, supplementing the survey published in Chemical Engineering in October 1954.

489. _____. Need Help in Finding Cost Data. Chem. Eng., vol. 61, No. 10, October 1954, pp. 185-193.

A bibliography and subject index prepared as an aid to find specific wanted information from great mass of literature on cost estimation. Index includes published references over a period of 8 years through 1953; material published before 1947 is not covered as thoroughly as more recent material.

The subject index lists 402 individual items involved in chemical-engineering economics.

Bibliography lists 351 articles dealing with equipment costs, operating costs, estimating methods, and project analysis.

490. WEBER, GEORGE. Commercial Atomic Processing Nears. Oil Gas Jour., vol. 54, No. 82, Nov. 26, 1956, pp. 54-55.

Discusses imminent possibility of commercial process to make polyethylene by irradiating ethylene, that is, a radiopolymerization process. An investment cost for a medium-size plant to produce 60,000 pounds of polyethylene per year is assumed to be $14,000,000 plus $5,000,000 for contingencies and working capital. Original radiation investment is assumed to range from $1,000,000 for spent-fuel elements to $4,320,000 for fission products. If cesium-137 at 50 cents per curie is used, $215,000,000 additional would be added to original investment.

491. WEIL, A. H. Economics of Modern Gas Dehydration. Petrol. Eng., vol. 27, No. 7, July 1955, pp. D-15 - D-18.

Discusses four types of dehydration plants, giving advantages and disadvantages of each. Cost data are presented in graphical form.

492. WEILER, VAL. Some Considerations of Cost in the Design of Pressure Vessels. Chem. Eng. Prog., vol. 50, No. 12, December 1954, pp. 622-625.

Compilation of comparative costs in design of pressure vessels to serve as guideposts to designers. Included are basic plate costs, basic pressure-container costs for a 6-foot-diameter, 40-foot-long vessel designed for 225 pounds per square inch, and installation cost of a 12-inch standard forged nozzle in a basic pressure container. Also discusses three principal applications of pressure vessels.

493. WESTON, ROY F., AND MERMAN, R. G. Pollution-Control Symposium - 3. Chemical Flocculation of Refinery Waste. Oil Gas Jour., vol. 53, No. 15, Aug. 16, 1954, pp. 118-121.

Detailed description of program and plant operation of 10,000-gallon-per-day chemical flocculation waste-treatment facilities at Philadelphia refinery of Atlantic Refining Co. Estimated cost is $2,500,000 - $5,000,000, exclusive of land and depending upon location.

Gives percentage breakdown (distribution) of construction costs.

494. WHITESIDE, A. E. How to Figure Your Power Needs. Oil Gas Jour., vol. 54, No. 87, Dec. 31, 1956, pp. 192-194, 197, 199, 201-212.

Presents detailed account of suggested method for maintaining continuous electric-power analysis. Includes data about economics of electric use, electric load in relationship to electric capacities, and product deliveries.

495. WIEGAND, R. A. Comparison of Chemical and Petroleum Accounting in Analysis of New Plants. Chem. Eng. Prog., vol. 51, No. 4, April 1955, pp. 199-204.

Using once-through cracking process compares similarities and differences between techniques and practices of oil and chemical companies in compiling economic evaluations of proposed ventures for presentation of capital expenditure. Gives comparisons in tabulated form of capital investment, utilities, raw materials, other direct costs, and indirect costs. Includes cost summary and a profitability comparison.

496. WILSON, NEIL, G. Chemicals Cut Pipeline R.O.W. Upkeep. Oil Gas Jour., vol. 54, No. 14, Aug. 8, 1955, pp. 88-90.

Describes results of a 4-year program by Shell Pipeline Corp. to chemically control weeds and brush on pipeline rights-of-way and compares costs of hand-cutting methods formerly used for this purpose with costs of chemical treatment.

497. _____. In-Tank Mixing of Crude Oil. Oil Gas Jour., vol. 53, No. 27, Nov. 8, 1954, pp. 165, 167-168.

Discusses application of in-tank mixers from pipeline and refinery standpoints with particular emphasis on economic advantages realized. Presents costs for cleaning sediment from tanks, including amount for marketable production, lost-tank bottoms, and cost of equipping tanks with mixers. No fixed cost was assigned to effects of crude-oil-gravity fluctuations on distillation, but estimates of throughput are given.

498. WINN, FRANCIS W. How to Invest Your Capital for Profits. Petrol. Refiner, vol. 35, No. 7, July 1956, pp. 199-210.

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Discusses "incremental present worth" method, which, if properly computed, is the one criterion applicable to any economic evaluation. Among proper criteria to consider for investment of capital, method described gives due consideration to all major factors, including risk.

499. WOODWARD, E. R. Hydrazine Cuts Water-Treating Costs. Petrol. Refiner, vol. 35, No. 12, December 1956, pp. 208-210.

Use of hydrazine in boiler feedwater treatment has been found to be a vast improvement over sodium sulfite. Hydrazine deoxygenates more efficiently without adding any dissolved solids and also effects a saving in actual material cost. Usually the hydrazine needed to remove oxygen costs less than the sodium sulfite it replaces.

500. WORLD OIL. Shale-Oil Cost Shrinks. Vol. 140, No. 6, May 1955, p. 88.

Comments briefly on Interior Department's Annual Report on Synthetic Liquid Fuels, which states that improved mining techniques and experimental scale development of Gas-Combustion retorting process may have reduced cost of shale oil production 25 percent during past 4 years.

501. WRIGHT, B. C. Hot-Spray Applications of Vinyl-base Paints. Oil Gas Jour., vol. 53, No. 32, Dec. 13, 1954, pp. 145-146.

Discusses application of vinyl-base paints as a coating to reduce corrosion. Experience showed that labor cost is 20 percent less than that for a similar job using a conventional 5-coat system. Other advantages,in addition to cost,are also cited.

Y

502. YARHAM, O. L. Successful Greasemaking Operation Begins on the Drafting Board. Oil Gas Jour., vol. 53, No. 31, Dec. 6, 1954, pp. 119-121.

Discusses newer trends and equipment in greasemaking. Brief cost figures shown; for example, cost of 1/6 hp.-hr. (1 man-hour) of mechanical work done by man is about $3 in production work. Installation of electric motor to do the same work would make the cost only one-third cent.

503. YINGLING, R. D. Cathodic Tank Protection - 5 Years Later. Oil Gas Jour., vol. 54, No. 42, Feb. 20, 1956, pp. 113-114.

Compares difference in average tank life since Gulf Oil Corp. undertook its cathodic protection program, and gives cost of corrosion as compared with cost of protection. Expense due to corrosion damage averaged about $24.50 per month per tank. Cost of cathodic protection varies from $1.50 to $2.50 per month.

504. YOUNGER, A. H. How to Size Future Process Vessels. Chem. Eng., vol. 62, No. 5, May 1955, pp. 201-202.

A list of factors to consider in designing vapor-liquid separators, accumulators, and knockout drums to reduce possibility of overdesigning.

Z

505. **ZABEL, HERMAN W.** The Exclusion Chart. Chem. Eng. Prog., vol. 52, No. 5, May 1956, pp. 183-186.

Use of exclusion charts as a method to determine price at which a given product must sell in order to be successful in competitive market. Various types of such charts are described, in conjunction with appropriate examples.

506. **ZAHNSTECHER, L. W., AND PETRARCA, C. A.** Achieving Catalytic Desulfurization of Petroleum Distillates. Oil Gas Jour., vol. 53, No. 33, Dec. 20, 1954, pp. 78-81.

Describes three classes of catalytic desulfurization: (1) Desulfurization in the absence of hydrogen; (2) desulfurization with hydrogen recycle to produce a hydrogen partial pressure at the reaction zone but with outside hydrogen makeup; and (3) desulfurization with both hydrogen recycle and hydrogen makeup. Includes economic comparison (investment and operating costs) of various classes of desulfurization by choosing three generalized cases with arbitrarily fixed operating conditions. Also included are several graphs that permit correction of investment and operating costs presented to 10,000 barrels per stream-day to those of different capacities.

507. **ZIMMERMAN, O. T.** Attain That Profit. Chem. Eng. Costs Quart., vol. 5, No. 3, July 1955, pp. 69-74.

Defines rate of return and presents a mathematical equation that expresses rate of return in terms of 13 variables. These variables are also defined, and factors that affect them are presented. Using plant data, effect of changes in variables are shown graphically for two conditions: (1) For manufacture of product X it was necessary to erect a plant building and install complete processing equipment; (2) for product Y space was available in an existing building, and principal item of new fixed capital expense was a large kettle.

508. **ZIMMERMAN, O. T., AND LAVINE, IRVIN.** Cost of Pipe and Nipples. Chem. Eng. Costs Quart., vol. 5, No. 3, July 1955, pp. 78-79.

Gives graphs containing curves that show costs of: (1) Wrought-steel pipe, (2) wrought-iron pipe, and (3) wrought-steel nipples for different strengths and sizes of pipe and nipples.

509. **_____.** Want Equipment Costs for Estimates? Petrol. Refiner, vol. 35, No. 8, August 1956, pp. 116-127.

Series of graphs presents costs of 11 types of process equipment, thereby facilitating quick estimates of equipment costs. Cost data have been adjusted to levels prevailing in March 1956. Items included are piping, heat exchangers, evaporators, filtration, equipment, thickeners and clarifiers, rotary driers, vacuum driers, mixers and mixing tanks, field-erected storage tanks, fans and blowers, and bubble-cap towers. Gives costs for reciprocating compressors and centrifugal pumps in a series of tables.

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